ABB Drives

**User's Manual**

# Advant Controller 80

# User’s Manual

## Advant Controller 80

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# Safety Instructions

## General Safety Instructions

**WARNING!** All electrical installation and maintenance work on the drive should be carried out by qualified electricians.

Any installation work must be done with the power off, and power is not to be reconnected unless the installation work is complete. Dangerous residual voltages remain in capacitors when the disconnecting device is opened. Wait 5 minutes after switching off the supply before starting work. Always ensure that the measured voltage between terminals UDC+ and UDC- and frame is close to 0 V and that the supply has been switched off before performing any work on the equipment or making main circuit connections.

If the main circuit of the inverter unit is live, the motor terminals are also live even if the motor is not running!

If there are inverters in parallel, open the switch fuses of all parallel connected inverters before installation or maintenance work on any of them.

If the auxiliary voltage circuit of the drive is powered from an external power supply, opening the disconnecting device does not remove all voltages. Control voltages of 115/230 VAC may be present on the digital inputs or outputs even though the inverter unit is not powered. Before starting work, check which circuits remain live after opening of the disconnecting device by referring to the circuit diagrams for your particular delivery. Ensure by measuring that the part of the cabinet you are working on is not live.

Control boards of the drive may be at the main circuit potential. Dangerous voltages may be present between the control cards and the frame of the converter unit when the main circuit voltage is on. It is critical that the use of measuring instruments, such as an oscilloscope, and their connection to the drive is done with caution and safety always a priority.

Live parts on the inside of doors are protected against direct contact. Special safety attention shall be paid when handling shrouds made of sheet metal.

Do not make any voltage withstand tests on any part of the unit while the unit is connected. Disconnect motor cables before making any measurements on motors or motor cables.

Do not open the drive section switch fuses when the inverter is running.

**CAUTION!** Fans may continue to rotate for a while after the disconnection of the electrical supply.

**CAUTION!** Some parts like heatsinks of power semiconductors inside of cabinet remain hot for a while after the disconnection of the electrical supply.

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# Chapter 1 – Introduction

## Overview

The Advant® Controller 80 (AC 80) is a high-performance programmable logic controller specially designed for drives.

Here are a few basic functions of the AC 80:

- Execution of fast drive control application programs
- Communication with drives
- Communication with other controllers
- Communication with S800 I/O, special I/O and fieldbus adapter units
- Modbus-protocol panel/printer port.

The AdvaBuild for Windows program suite (more specifically, the Function Chart Builder) can be used for programming, configuring and diagnosing of the AC 80. Configuring and programming the AC 80 looks and feels the same as other Advant controllers. Compatibility to the APC2 (Application Program Controller; the previous-generation controller) is preserved when using function blocks from the APC2 library.

PM825, the processor module of the AC 80, is based on an MC68360 microprocessor running at 25 MHz in 16-bit mode. The system and user application programs are stored in 1024 KB and 512 KB of FLASH PROM respectively. 1024 kilobytes (512K*16bit) of RAM is available for the execution of the system and user application programs.

The AC 80 may be used either independently (stand-alone) or as part of an AF 100 (Advant Fieldbus 100) network. The user interfaces of the AC 80 are Drive*Window,* Modbus-protocol panels and printers, and the Man-Machine Interface via AF 100.

## What This Manual Contains

Chapter 2 contains a description of the AC 80 hardware and connections, including terminal designations and bus topology diagrams.

Chapter 3 is a summary of the software relating to the AC 80. It deals with the programs residing in the AC 80 as well as supporting PC software.

Chapter 4 explains how the connections of the AC 80 are set up in the AC 80 application program. This chapter is mainly intended for persons responsible for the application program of the AC 80. The reader is expected to have a knowledge of AdvaBuild/Function Chart Builder programming.

Chapter 5 gives information on diagnosing the AC 80 using its LEDs and the supporting PC software.

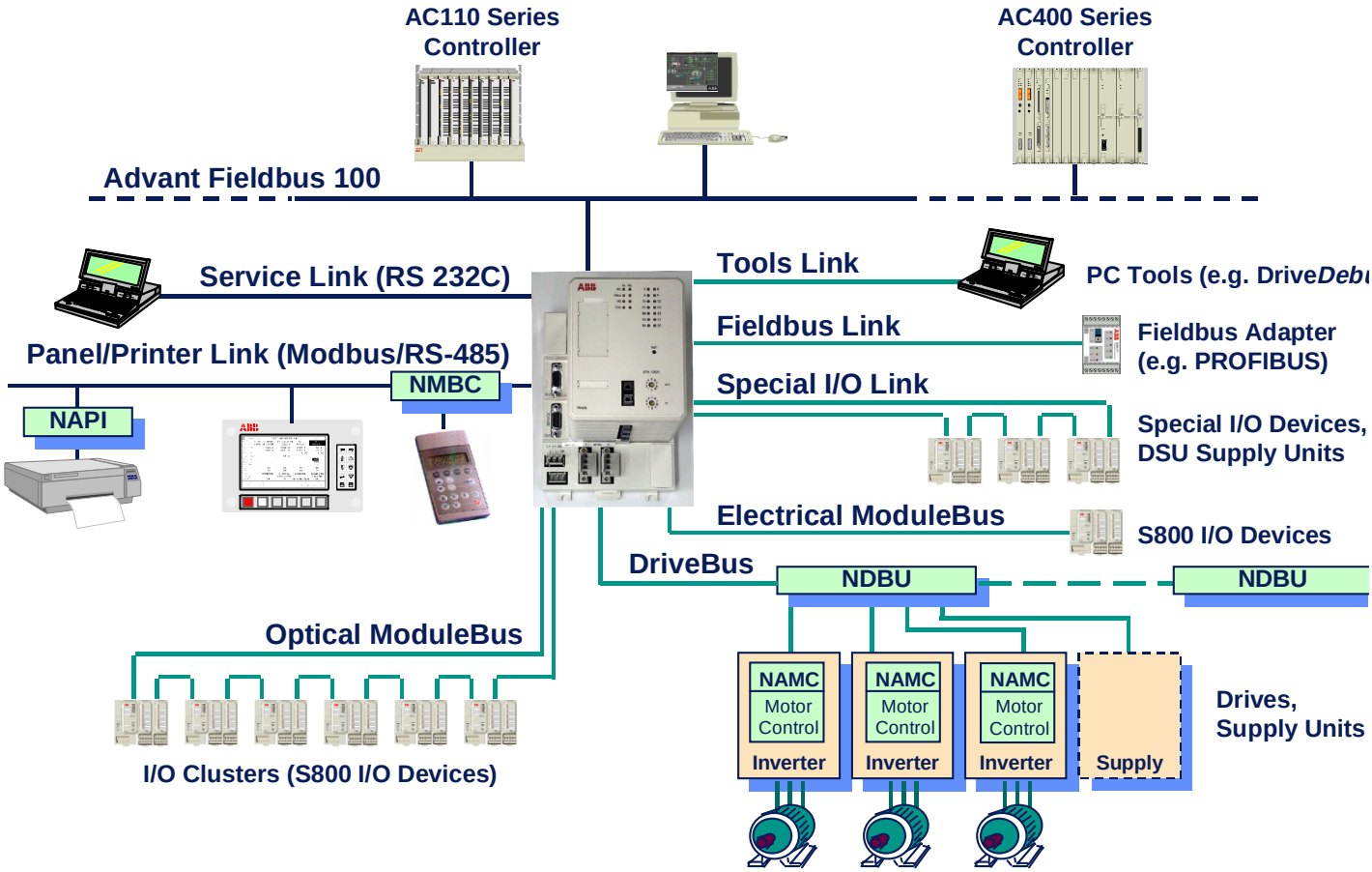



*Figure 1-1 AC 80 Connections.*

## Terms, Abbreviations and Definitions

*AdvaBuild (for Windows)*
A package of programming tools.

*Advant Fieldbus 100 (AF 100)*
A twisted pair fieldbus that provides communication between Advant Controllers, I/O stations and higher-level computer systems.

*APC2*
Application Program Controller; previous-generation drive-specific control system.

*Control Panel*
A separate device which can be used for diagnostics and control, e.g. CDP 80, AOS.

*DDCS*
Distributed Drives Communication System; a communication protocol used in fibre optic links in ABB drives.

*Drive*
A single NAMC-based inverter, or several inverters each containing an NAMC board, connected to one line-up.

*DSU*
Diode Supply Unit; one of ACS 600 supply unit types.

*FCB*
Function Chart Builder; part of AdvaBuild; a PC tool for writing application programs.

*FCI*
Fieldbus Communication Interface; contains an interface to the AF 100 fieldbus, a ModuleBus interface, and power regulators. The FCI uses S800 I/O devices. For further information on FCI units, refer to the *S800 I/O User's Guide*.

*Fieldbus Adapter*
A device that allows communication with another fieldbus system, e.g. PROFIBUS DP, InterBus-S.

*GOP*
Graphic Operator Panel; a type of control panel used especially in Pulp & Paper applications.

*I/O*
Input/output.

*I/O Cluster*
An extension of the ModuleBus optical link of an AC 80. Consists of a ModuleBus modem with I/O devices.

*I/O Device*
A complete I/O device consists of one MTU and one I/O module.

*I/O Module*
The active, electronic, and signal conditioning part of an I/O device.

*I/O Station*
An I/O station consists of an AC 80 (or an FCI), 1 to 7 I/O clusters and up to 24 I/O devices.

*ISU*
Inverter Supply Unit; one of ACS 600 supply unit types.

*ModuleBus*
An incremental, electrical or optical bus for interconnection of I/O devices.

*MTU*
Module Termination Unit; a passive unit onto which an I/O module is mounted. The MTU contains the process I/O terminals and part of Electrical ModuleBus.

*OSP*
Outputs Set as Predetermined; a user-configurable action on an output module when communication is lost to the AC 80.

*S800 I/O*
Type of a distributed modular I/O unit which communicates with Advant controllers over an AF100 bus or directly with AC 80.

*Special I/O*
An interface for special I/O, such as the NBIO-31 I/O unit, the NPCT-01 Pulse Counter Board, or DSU connections.

*Tools*
PC software (such as Drive*Window* and FCB) used for monitoring and controlling drives, or designing drive application programs.

*TSU*
Thyristor Supply Unit; one of ACS 600 supply unit types.

## Related Publications

*AC 80 PC Elements Reference Manual* (3BFE 64021737, English)

*Advant Fieldbus 100 User's Guide* (3BSE 000 506, English)

*Firmware Manual for ACS 600 System Application Program* (3AFY 63700177, English)

*Firmware Manual for ACS 600 Standard Application Program* (3AFY 61201441, English)

*Function Blocks for APC2* (3AFY 61281240, English)

*S800 I/O User's Guide* (3BSE 008 878, English)

*Use of PROFIBUS-DP Protocol in Advant Controller 80* (3BFE 64248260, English).

# Chapter 2 – AC 80 Hardware and Connections

## AC 80 Hardware

The AC 80 is built in a ventilated plastic housing. It can be mounted onto a horizontal or vertical DIN 50022 rail. The module can be removed by pulling the locking spring (at the bottom of the unit) downwards e.g. with a screwdriver.

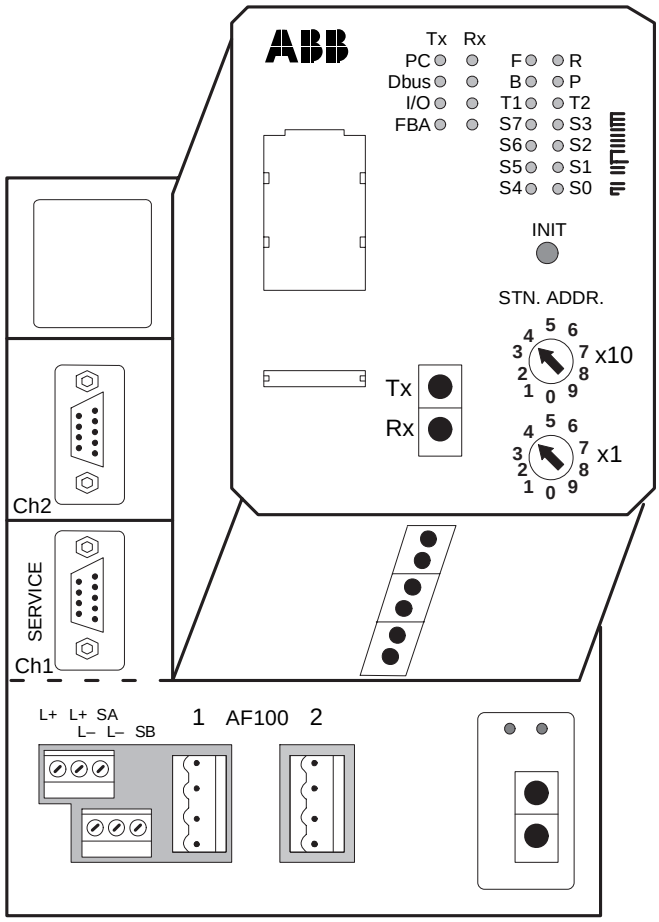
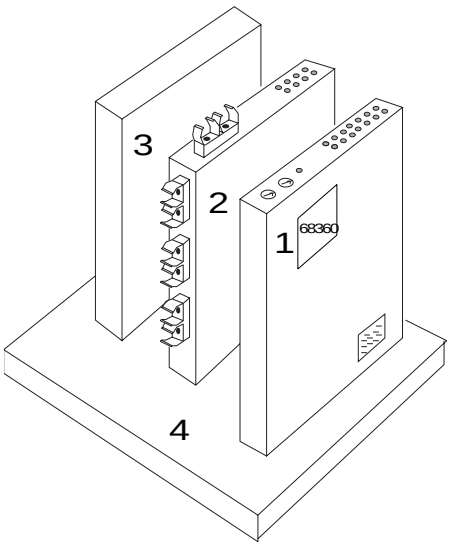



*Figure 2-1 The AC 80.*

### Circuit Board Layout




1 – CPU board PM820-2
2 – NCB board PM825-1
3 – Power supply PM820-1
4 – Terminal board TC820-1

*Figure 2-2 The circuit boards of the AC 80.*

### Block Diagram

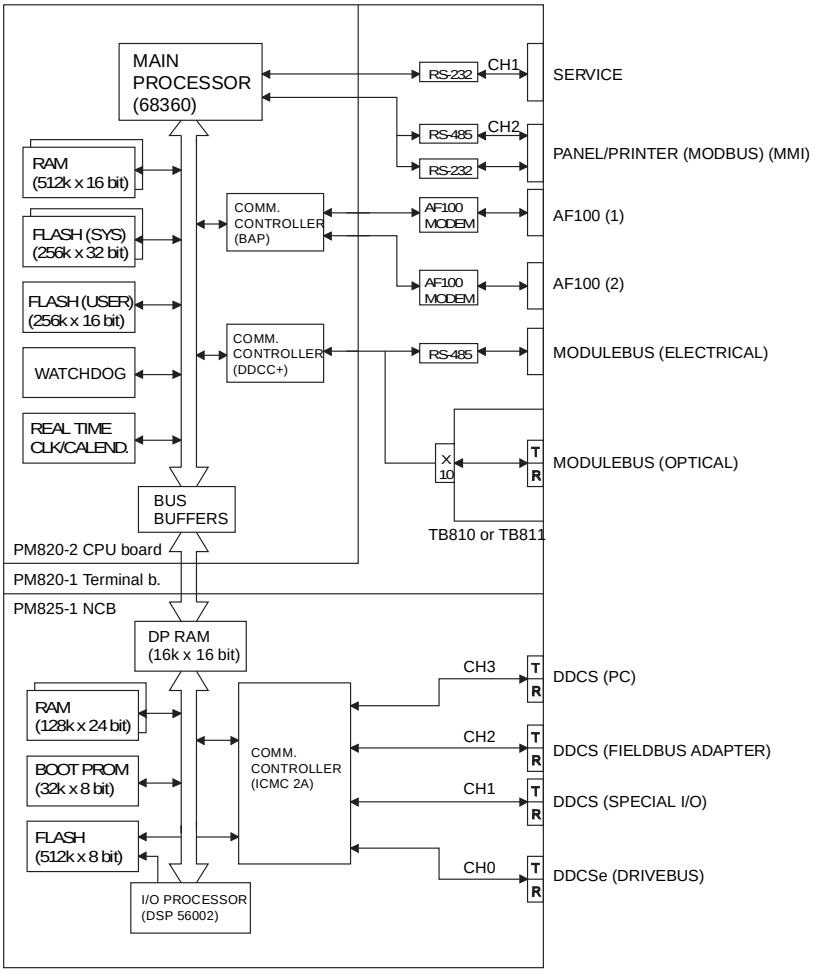



*Figure 2-3 AC 80 block diagram.*

***LEDs*** The LEDs on the AC 80 can be divided into three groups, i.e. bus indicator LEDs, general purpose LEDs, and special purpose LEDs. (Further information on the LEDs is given in *Chapter 5 – Diagnostics).*

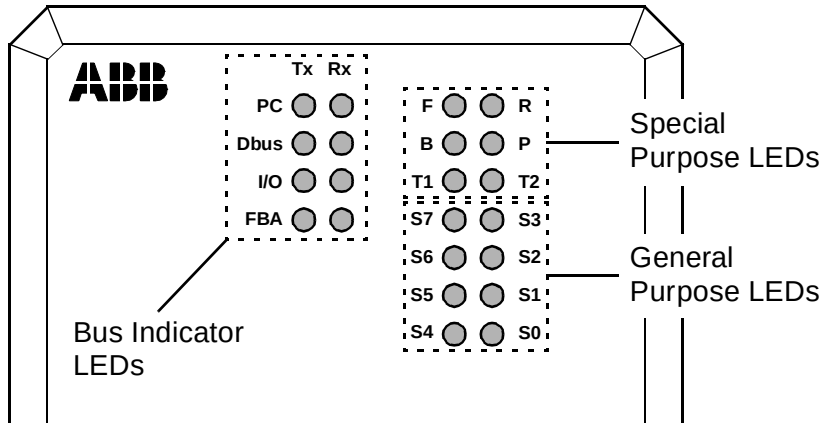



*Figure 2-4 LEDs of the AC 80.*

*Bus Indicator LEDs* These LEDs show the status of the fibre optic channels. The LEDs are laid out in the same order as the optic terminals on the AC 80.

Note that the Rx LEDs light when data is received from the fibre optic link. The Tx LEDs are controlled by the AC 80 itself.

*Special Purpose LEDs* **F** – Fault (red): This LED switches automatically on after the power-up of the AC 80. The system application program also lights this LED if the self test fails. In case of a serious hardware or program error, this LED lights. Simultaneously, the general purpose LEDs indicate an error code. ***Note:*** The error codes are given in *Chapter 5 – Diagnostics.*

**R** – Run (green): This LED is lit when the system application starts to run. It turns off upon serious hardware or program errors.

**P** – Power (green): This LED indicates that the power supply to the AC 80 is good. The P LED is independent of system program status.

**B** – Battery (green): This LED indicates that the voltage level of the battery is sufficient for backing up the internal real time clock and buffered read/write memory. If no battery is inserted, or it is low, the B LED is turned off.

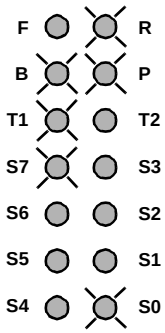
**T1**, **T2** (yellow): These LEDs indicate data being received on the AF 100 channels 1 and 2 respectively. If the AC 80 is not connected to AF 100, these LEDs are off. If the AC 80 is connected to the AF 100 with only one cable, one of the LEDs should be on, the other LED off.

*General Purpose LEDs*

When the **S7** LED is **on**, and the **F** LED is **off**, S0 to S6 indicate the AC 80 status as follows:

| S7 | S6 | S5 | S4 | S3 | S2 | S1 | S0 | AC 80 Status | |
|---|---|---|---|---|---|---|---|---|---|
| on | | | | | | | | P- | CPU in initial phase |
| on | | | | | | | on | P1 | CPU in operational mode |
| on | | | | | | on | on | P3 | CPU has stopped after initialisation. START MODE attribute at DB element has been set to STOP |
| on | | | | | on | | | P4 | CPU is not running an application program |
| on | | | | | on | | on | P5 | CPU is loading an application program from the internal PROM |
| on | | | | | on | on | | P6 | Programming tool is connected (CPU is in on-line mode) |
| on | on | on | on | | | | | -- | Boot-up program erasing system PROM (prepare for loading) |
| on | on | on | on | on | on | on | on | PL | Boot-up program waiting for system program download (after erasure or detection of corrupt program in system PROM) |

The normal operation state (P1) is indicated as shown below:




When the **S7** LED is **off**, and the **F** LED is **on**, S0 to S6 indicate an error code. See *Chapter 5 – Diagnostics* for details.

### *Station Address Selection*

The AC 80 is equipped with two address selection switches. They are used for defining an exclusive station address for the AC 80 on the AF 100 bus. The address must be in the range of 1 to 79; setting the address outside this range renders the AC 80 unaccessible via AF 100.

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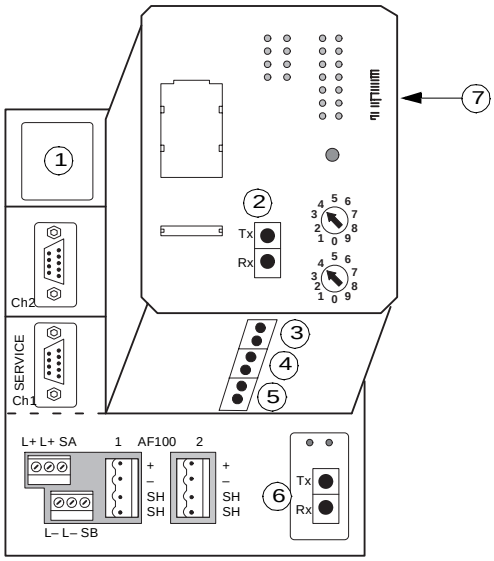
***Note:*** The address selected with the hardware switches must match the station number setting in the application program (STNNO in PM825 element, AF 100 part).

---

### *The INIT Button*

Pressing the INIT button performs a “cold start”, i.e. the AC 80 performs self tests, checks the user memory for a valid application and activates it, runs a complete initialisation and I/O module configuration.

## AC 80 Connections




| Name | Terminal (see above) | For connection of | Cable | Data | Remark |
|---|---|---|---|---|---|
| Power Supply | L+ L+ SA<br>L– L– SB | Power Supply | 0.2 to 2.5 $mm^2$ | +24 V d.c.<br>(19.2 to 30 V) | Redundancy available |
| AF 100 | AF100 1<br>AF100 2 | AF 100 (Advant Fieldbus 100) | Screened twisted pair | Max. length 750 m<br>Max. no. of nodes 32 | Redundancy available |
| Service | Ch1<br>(Terminal Board X4) | PC (Configuration and Maintenance) | RS-232 | RS-232 signal levels<br>Max. comm. 20 kbit/s | D-sub<br>9-pole |
| Panel/Printer | Ch2<br>(Terminal Board X5) | CDP 80 Ctrl. Panel<br>Alarm printer<br>GOP Panel | RS-485 | Protocol: Modbus<br>RS-485 signal levels<br>Max. comm. TBD | D-sub<br>15-pole |
| Battery | ① | Battery | – | Lithium 3.6 V 900 mAh | 14.5 × 25 mm |
| Tool* | ②<br>(NCB CH3) | PC tools<br>(Drive*Debug*) | Fibre optic | Protocol: DDCS | 10 MBd optical components |
| DriveBus* | ③<br>(NCB CH0) | ABB drives<br>Branching units | Fibre optic | Protocol: DDCS, DDCSe | 10 MBd optical components |
| Special I/O* | ④<br>(NCB CH1) | NBIO-21, NBIO-31, NPCT-01, DSU | Fibre optic | Protocol: DDCS | 5 MBd optical components |
| Fieldbus Adapter* | ⑤<br>(NCB CH2) | Fieldbus Adapters, e.g. NPBA-80 | Fibre optic | Protocol: DDCS | 5 MBd optical components |
| Optical ModuleBus (optional)* | ⑥ | TB820 Modems<br>ABB drives | Fibre optic | Protocol: DDCS<br>Max. 12 I/O units in max. 7 clusters | Requires TB810/811 Optical Port |
| Electrical ModuleBus | ⑦ | S800 I/O units | C/4 Plug-in | Max. 12 I/O units<br>24 V supply 1.0 A<br>5 V supply 2 A | |

*Colour codes: Grey: Transmitter, Blue: Receiver.

### Power Supply Connection

The AC 80 is powered by a single or redundant 24 V d.c. (19.2 to 30 V) supply. The table below gives the current consumption at three different voltages (without I/O modules).

| Voltage [V d.c.] | Current [mA] | |
|---|---|---|
| | Typical | Maximum |
| 19.2 | 310 | 520 |
| 24 | 250 | 415 |
| 30 | 200 | 330 |

*Power Supply Terminals*

The power supply terminals accept wire sizes from 0.2 to 2.5 $mm^2$ (24 to 14 AWG). The terminal designations are as follows:

| X1B | Designation | Description |
|---|---|---|
| 1 | L+ | +24 V (in) |
| 2 | L+ | +24 V (out) |
| 3 | SA | Redundant power supply monitor input |

| X1A | Designation | Description |
|---|---|---|
| 1 | L– | 0 V (in) |
| 2 | L– | +0 V (out) |
| 3 | SA | Redundant power supply monitor input |

***Note:*** It is recommended that the AC 80 and the I/O devices be powered from separate supplies.

## Non-redundant Power Supply Connection

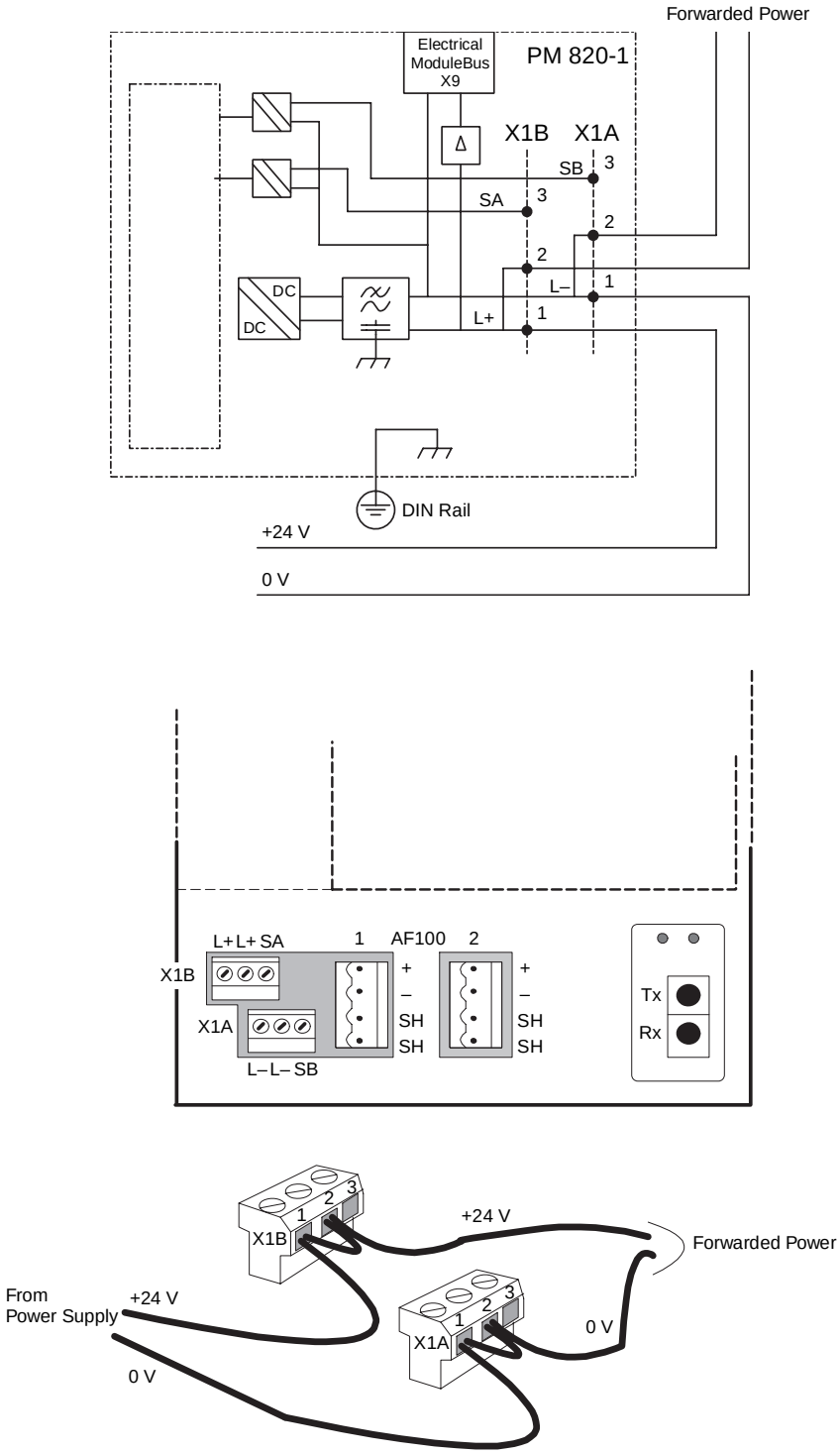



*Figure 2-5 Non-redundant power supply connection.*

## Redundant Power Supply Connection

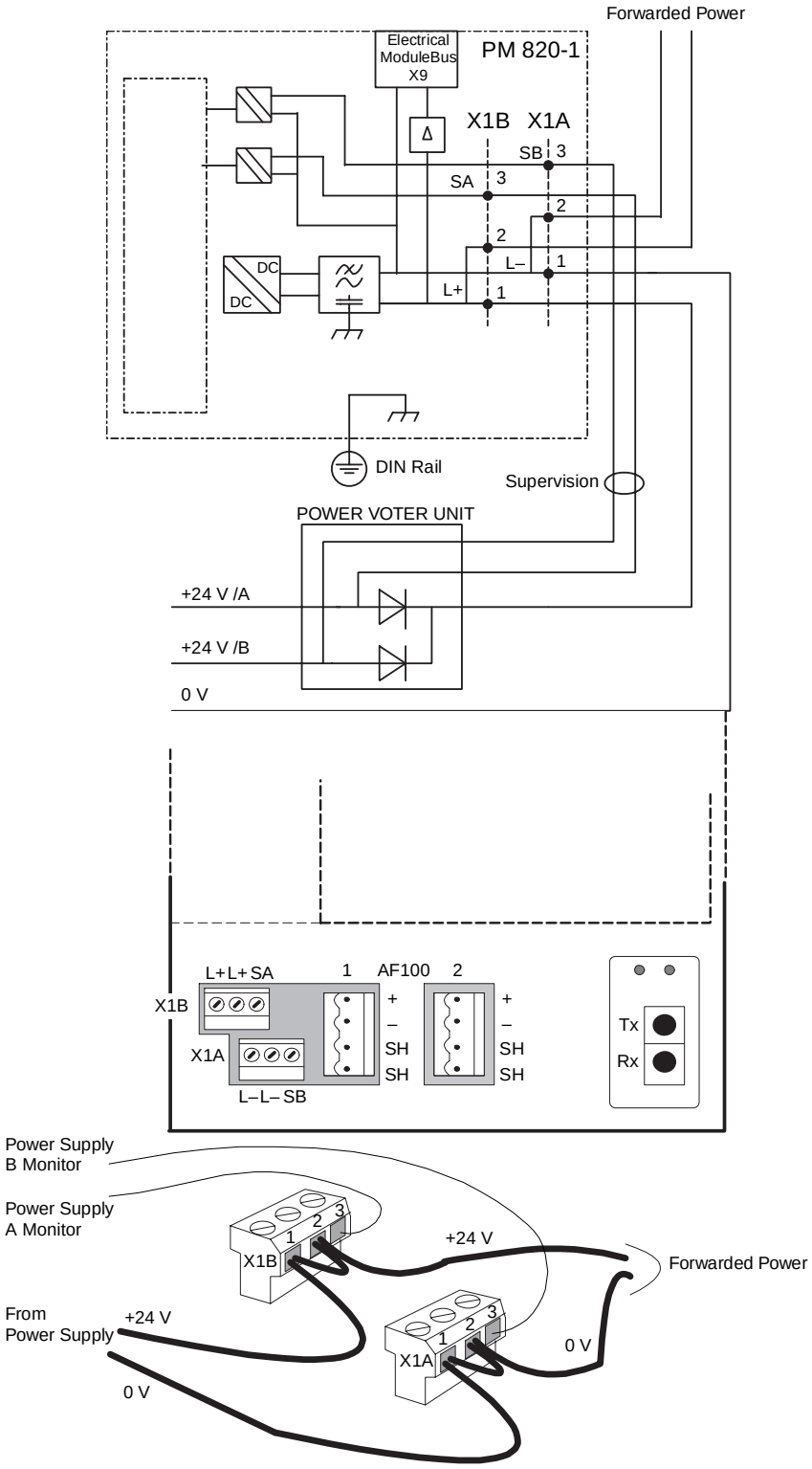



*Figure 2-6 Redundant power supply connection.*

*Power-up Procedure*

1. Measure that the voltages are correct on the power switch unit.
2. Switch on the circuit breakers on the power switch.
3. The AC 80 indicates the power-on status with the following LEDs:

| Function | LED Colour | LED Designation |
|---|---|---|
| Operating OK | Green | R |
| Power OK | Green | P |
| Battery OK | Green | B |
| AF 100 Active | Yellow (flashing) | T1 and T2 |
| States P1 to P6 | Yellow | see page 2-4 |
| Fault/Alarm, I/O Modules/PM820-2 | Red | F |

### ModuleBus Connection

ModuleBus is used for connecting I/O devices (or ABB drives) to the AC 80. It is divided into electrical and optical busses which are logically the same bus.

*Electrical ModuleBus*

The electrical ModuleBus link is made up of I/O devices installed side by side on the same mounting rail as the AC 80 itself. Extension cables may also be used as shown below e.g. in order to install I/O devices of different types onto different mounting rails. The bus is terminated at the end with a TB807 terminator latch. The maximum length of the bus is 2 metres including the AC 80, all I/O devices and extension cables.

Each I/O device consists of a module termination unit (MTU) and an I/O module installed on it. For more information on the different I/O devices available, refer to the *S800 I/O User's Guide*.

*Optical ModuleBus*

The optical ModuleBus link is constructed as a ring on the optional TB810/811 Optical Port, plugged onto the AC 80. The maximum communication speeds for the TB810 and TB811 are 10 and 5 Mbit/s respectively.

Each I/O cluster is built around a TB820 ModuleBus Optical Modem, and forms an individual electrical ModuleBus. Each cluster is given a cluster address using the selector on the TB820. Instructions for this as well as other detailed information on the TB820 is available from the *S800 I/O User's Guide.*

*Size of the I/O Station*

The I/O station may contain 24 I/O devices at most, i.e. 12 devices on the electrical and 12 on the optical ModuleBus. One I/O station can handle up to 384 digital I/O signals or 192 analogue I/O signals. The optical ModuleBus link may contain up to 7 I/O clusters.

The modules are addressed according to their physical order on the bus.

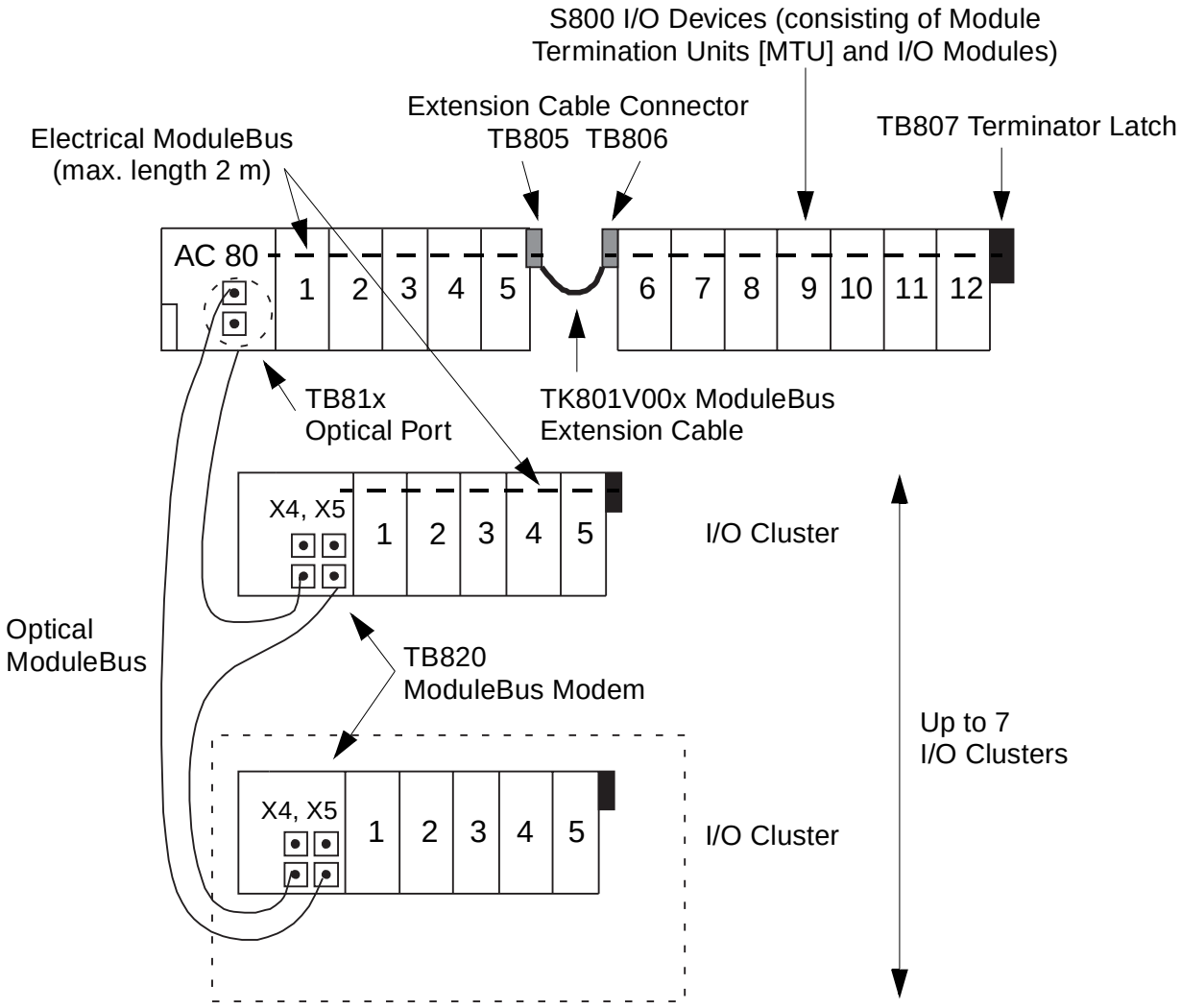

S800 I/O Devices (consisting of Module Termination Units [MTU] and I/O Modules)
Extension Cable Connector TB805 TB806
TB807 Terminator Latch
Electrical ModuleBus (max. length 2 m)
AC 80
1 2 3 4 5 6 7 8 9 10 11 12
TB81x Optical Port
TK801V00x ModuleBus Extension Cable
X4, X5
1 2 3 4 5
I/O Cluster
Optical ModuleBus
TB820 ModuleBus Modem
Up to 7 I/O Clusters
X4, X5
1 2 3 4 5
I/O Cluster

*Figure 2-7 An I/O station. The diagram shows I/O devices installed on both electrical and optical ModuleBus.*

***DriveBus Connection***

The optical DriveBus link (Channel 0 on the NCB board) can be used for controlling 12 NAMC-based drives, inverter units or supply units. The connection of multiple drives requires the use of a branching unit (NDBU), which enables the construction of a logical bus with physical star topology. Branching units can be chained together.

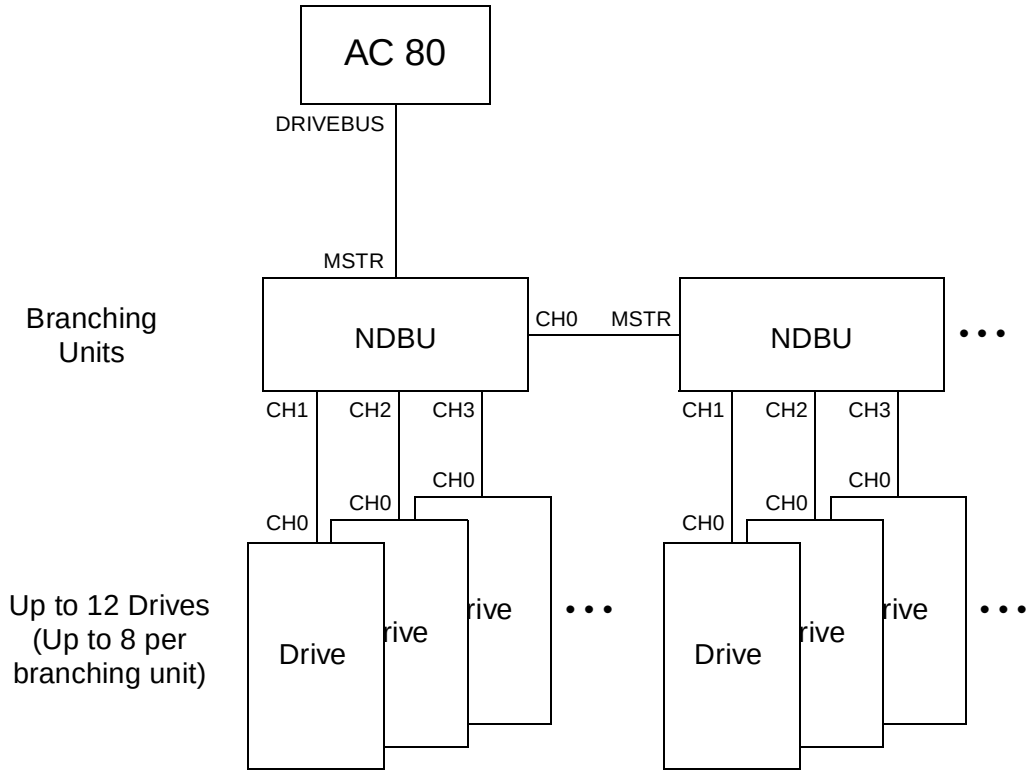



*Figure 2-8 DriveBus topology.*

DriveBus uses a communication speed of 4 Mbit/s (8 Mbit/s provisional), with a message cycle time of 50 µs (asynchronous). The specified transfer capability is 20 messages (10 data set pairs) per millisecond, the maximum being 32 messages/ms.

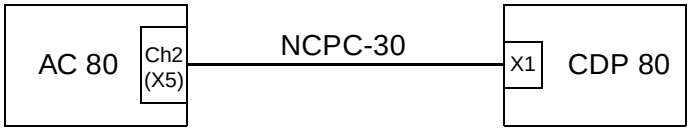
The DriveBus link can employ both plastic and HCS fibre optic cables. The use of HCS cables enables higher speed and longer distances; the maximum length of the bus is 15 m for plastic cable, 200 m for HCS cable. The communication speed and light intensity are set with jumpers on the NDBU board.

### *Panel/Printer Connection (Ch2)*

The panel/printer connector, labelled Ch2, is a Modbus-protocol RS-485 interface for up to 8 devices. The panel/printer link can be operated in two modes (only one of which can be active at a time):

Panelbus mode: for connection of Slave devices such as

- CDP 80 Control Panel. If it is the only device on the link, the CDP 80 can be directly connected to the panel/printer connector using an NCPC-30 cable as shown below




- Centronics-interface alarm printer (see the wiring principle diagrams below for additional equipment required)
- The Graphical Operator Panel (GOP). ***Note:*** Although the GOP can be operated in Panelbus mode, MultiVendor mode is recommended.

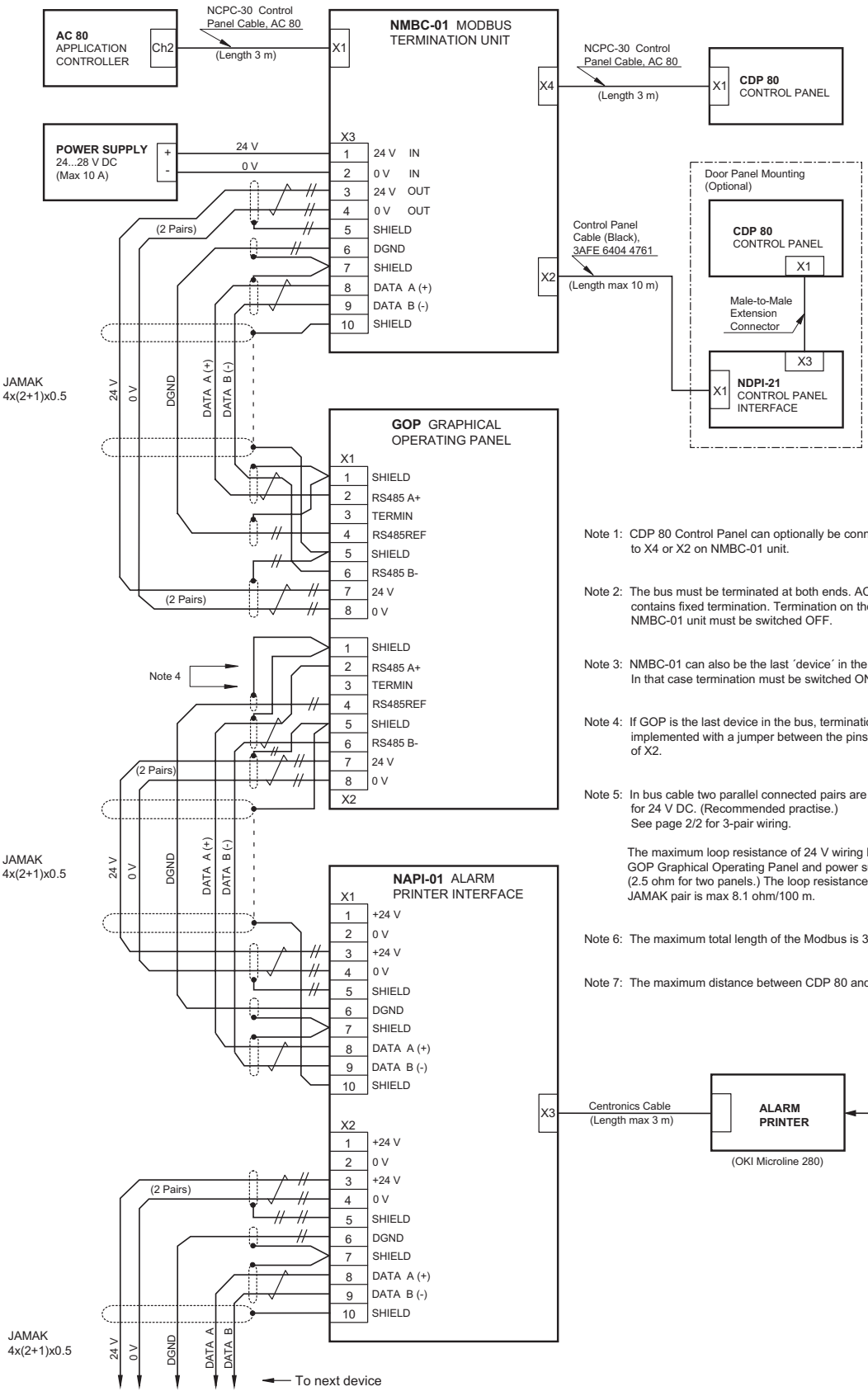
MultiVendor mode: for connection of

- Graphical Operator Panel (GOP) (see the wiring principle diagrams below for additional equipment required)
- external Modbus-protocol Slave or Master devices.

MultiVendor mode requires the installation of the optional Embedded Modbus elements.

*Wiring Principle*

The wiring principle of the panel/printer link is shown on the next two pages.




Note 1: CDP 80 Control Panel can optionally be connected to X4 or X2 on NMBC-01 unit.

Note 2: The bus must be terminated at both ends. AC 80 contains fixed termination. Termination on the first NMBC-01 unit must be switched OFF.

Note 3: NMBC-01 can also be the last ´device´ in the bus. In that case termination must be switched ON.

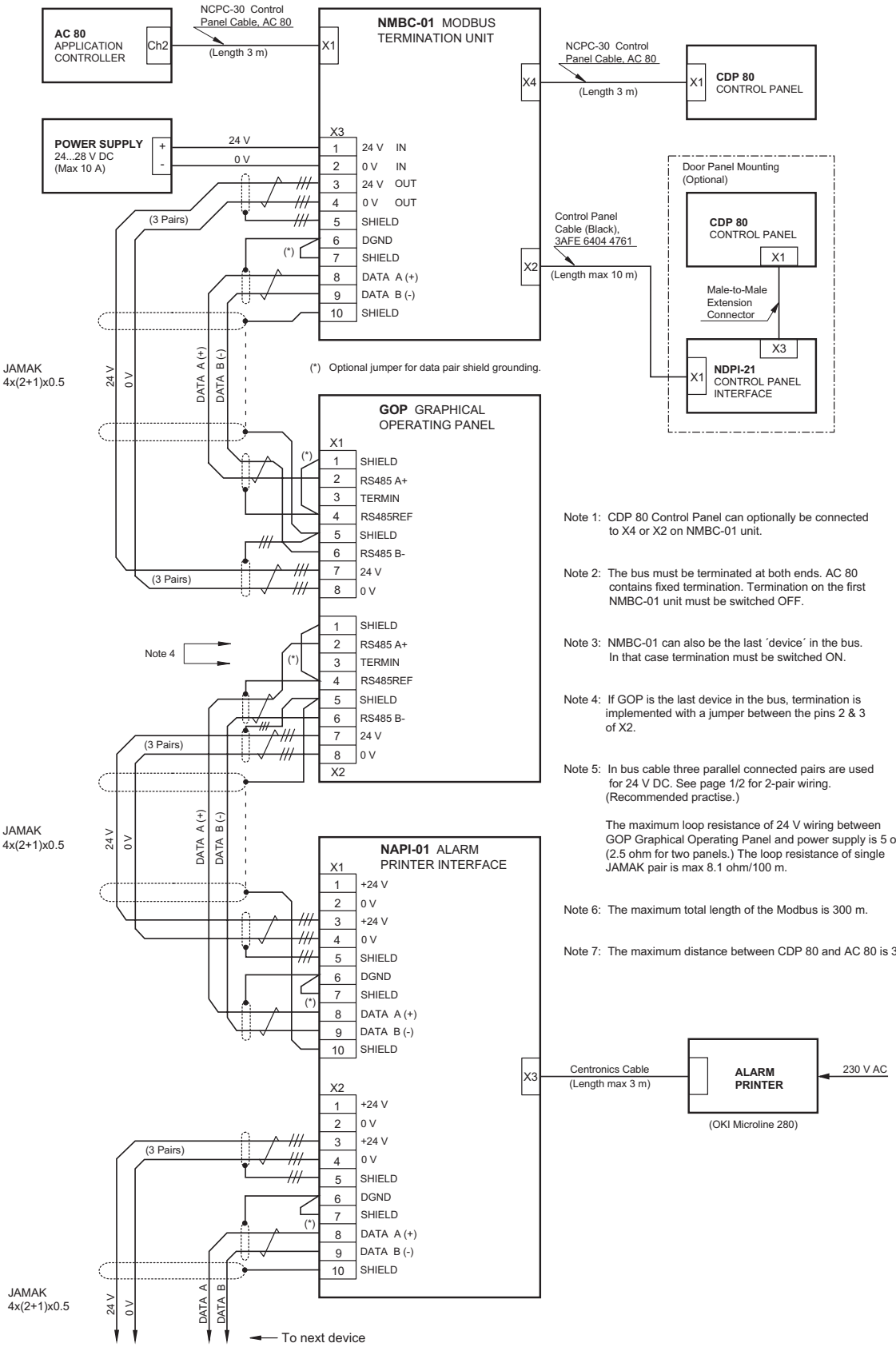
Note 4: If GOP is the last device in the bus, termination is implemented with a jumper between the pins 2 & 3 of X2.

Note 5: In bus cable two parallel connected pairs are used for 24 V DC. (Recommended practise.) See page 2/2 for 3-pair wiring.

The maximum loop resistance of 24 V wiring between GOP Graphical Operating Panel and power supply is 5 ohm. (2.5 ohm for two panels.) The loop resistance of single JAMAK pair is max 8.1 ohm/100 m.

Note 6: The maximum total length of the Modbus is 300 m.

Note 7: The maximum distance between CDP 80 and AC 80 is 30 m.




Note 1: CDP 80 Control Panel can optionally be connected to X4 or X2 on NMBC-01 unit.

Note 2: The bus must be terminated at both ends. AC 80 contains fixed termination. Termination on the first NMBC-01 unit must be switched OFF.

Note 3: NMBC-01 can also be the last ´device´ in the bus. In that case termination must be switched ON.

Note 4: If GOP is the last device in the bus, termination is implemented with a jumper between the pins 2 & 3 of X2.

Note 5: In bus cable three parallel connected pairs are used for 24 V DC. See page 1/2 for 2-pair wiring. (Recommended practise.)

The maximum loop resistance of 24 V wiring between GOP Graphical Operating Panel and power supply is 5 ohm. (2.5 ohm for two panels.) The loop resistance of single JAMAK pair is max 8.1 ohm/100 m.

Note 6: The maximum total length of the Modbus is 300 m.

Note 7: The maximum distance between CDP 80 and AC 80 is 30 m.

### *AF 100 Connection*

The AC 80 is connected to the AC 400 series controller via an AF 100 bus. It is also possible to connect several AC 80 units together with an AF 100 bus (a bus administrator required).

For AF 100 connection, the AC 80 must have an exclusive address number in the range of 1 to 79.

The AF 100 fieldbus is connected to the terminals labelled *AF100* (see below). Redundancy is gained when both channels are connected. However, the same cable should not be connected to both 1 and 2. The pin designations for the AF100 terminals (1 and 2) are as follows:

| Pin | Designation | Description |
|---|---|---|
| 1 | + | Signal + |
| 2 | – | Signal – |
| 3 | SH | Shield (Screen) |
| 4 | SH | Shield (Screen) |

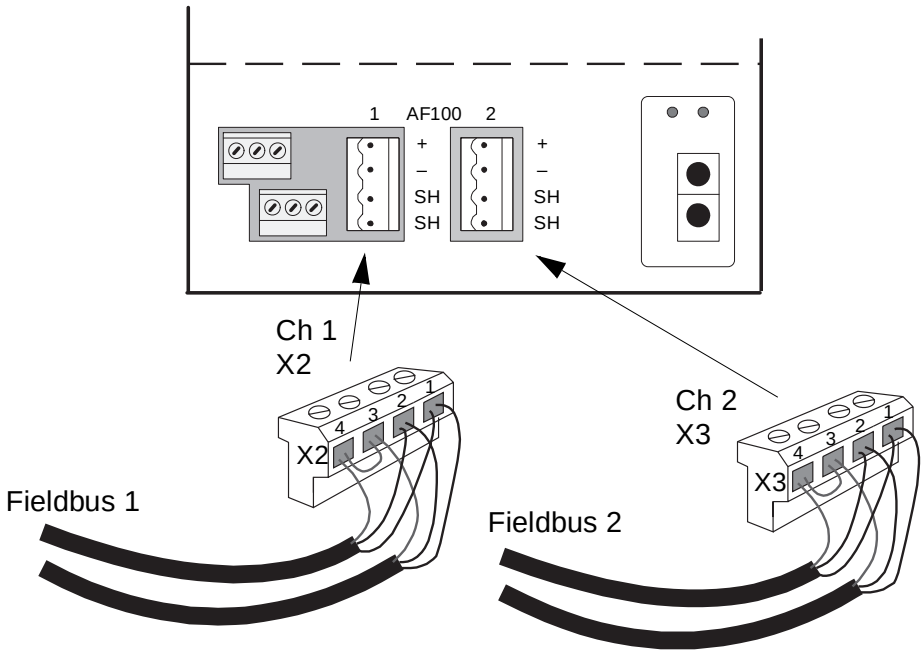



*Figure 2-9 Connecting the AC 80 to the AF 100 bus.*

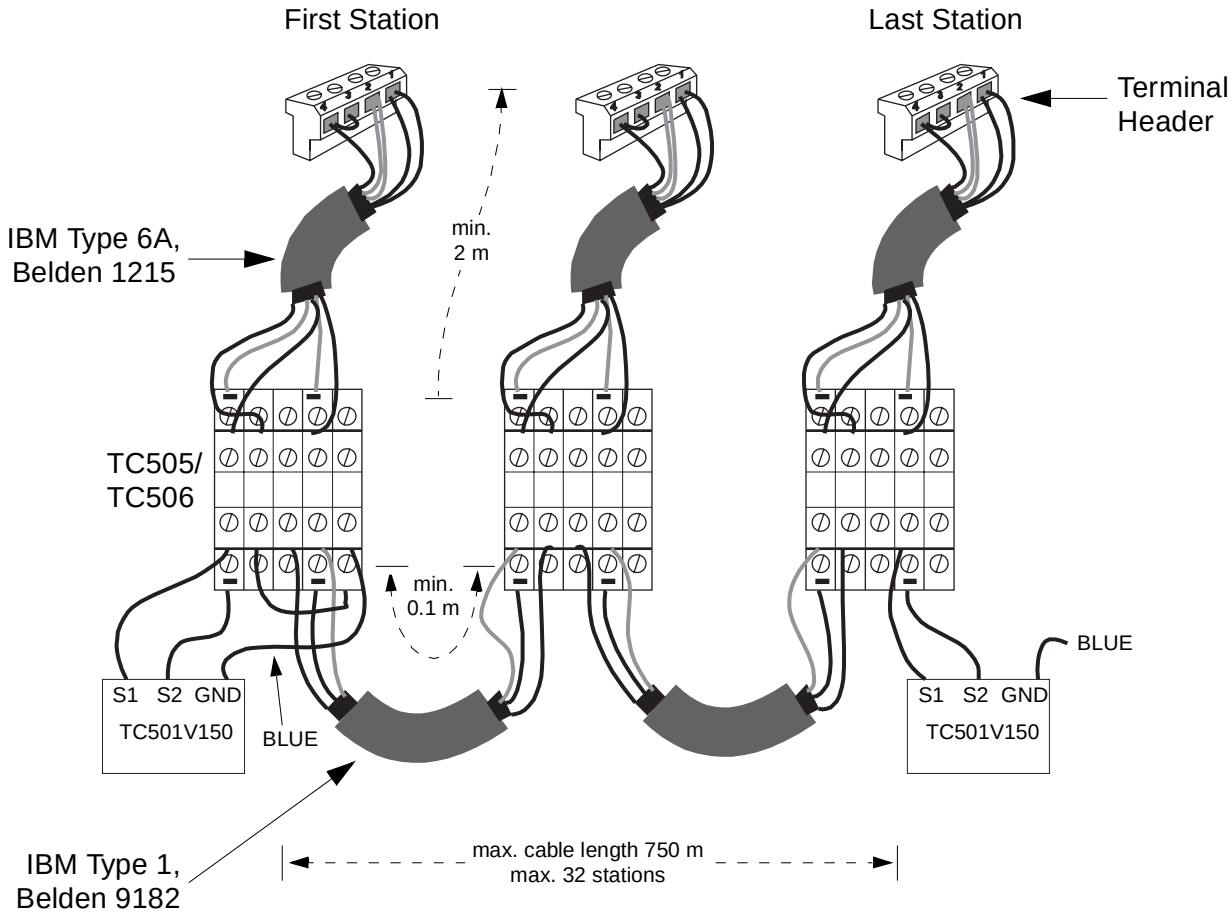



*Figure 2-10 AF 100 bus connection diagram.*

When connecting the station to the AF 100 twisted pair bus cable, the incoming and outgoing cables can be connected either directly to the terminal header or to a TC505/TC506 connection unit.

The minimum distance between stations is 4 metres. If the stations are located inside the same cabinet, the minimum distance can be shorter if the total bus length does not exceed 10 metres.

The TC501V150 is a termination unit for twisted pair cable (150 ohms).

***Special I/O Connection***

This DDCS-protocol fibre optic link (Channel 1 on the NCB board) can be used for connecting up to eight I/O devices to the AC 80. The devices are addressed 1 to 8, and connected in a ring.

The transmission speed of the Special I/O connection is 4 Mbit/s.

The Special I/O connection can be used with the following devices:

- NBIO-21 (Basic I/O Unit 2), an I/O module with 2 analogue inputs, 2 analogue outputs, 3 digital inputs and 2 digital outputs. (One digital input and one digital output are dedicated for the emergency stop function.)
- NBIO-31 (Basic I/O Unit 3), an I/O module with 4 digital inputs and 3 digital outputs. (One input and one output are dedicated for the emergency stop function.)
- NPCT-01 (Pulse Counter and Timer Unit), an I/O module with two incremental encoder inputs, 4 digital inputs and 4 digital outputs.
- NDSC-01, the control board of a Diode Supply Unit (DSU).

***Fieldbus Adapter Connection***

This DDCS-protocol, 4 Mbit/s fibre optic link (Channel 2 on the NCB board) can be used for connecting the AC 80 to a fieldbus such as PROFIBUS-DP. A fieldbus adapter module acts as an interface between the fibre optic link and the serial bus.

***Tool Connection***

This DDCS-protocol fibre optic link (Channel 3 on the NCB board) can be used for connecting the AC 80 to a PC with e.g. Drive*Debug.*

The PC must be equipped with a PCMCIA/DDCS (laptop) or an ISA/DDCS (desktop) interface.

The transmission speed used is 1 Mbit/s.

# Chapter 3 – AC 80 Software

## Overview

The AC 80-related software can be divided into two parts:

- AC 80 software
  – AC 80 CPU program
  – AC 80 NCB program
- AC 80 software support on the PC.

## AC 80 CPU System Program

The CPU system program consists of the boot program, base software, and the application program. These are executed in the AC 80 CPU.

### Boot Program

The boot program resides permanently in the AC 80 CPU. It receives the base SW upon downloading.

### Base Software

The base software consists of the following parts:

- Real-time operative system based on VRTX32
- HLSC for communication over the Service port (Ch1)
- Communication for drivers for AF100, ModuleBus and the Panel/ Printer link
- Target code for PC element libraries, divided into:
  – libraries common to both AC 70 and AC 80
  – Drives-specific libraries
  – PC element options.

The base software is executed in non-volatile system FPROM. It can be updated by downloading a new revision.

### Application Program

The application program consists of the following parts:

- PC part
- DB part
- Parameter data (PARDATs).

The PC part is headed by 1 PCPGM element, and may have up to 31 tasks (CONTRM, MASTER).

The DB part may include the following DB elements:
– PM825 (AC 80 configuration)
– S800 DB elements (for S800 I/O)
– DATs
– DSP
– NCB elements (DRB00, IO00, DCB00)
– Embedded Modbus options (MVB, MVI)
– Events options (EVS, EVENT).

PARDAT handling on the AC 80 differs from that of the AC 70 or APC2. The actual PARDAT values are stored in a separate segment in non-volatile FLASH PROM.

The application program is prepared by using the FCB (Function Chart Builder) tool. The target code is generated by selecting **File – Generate Target Code…**. When connected, FCB downloads the application program with the command **Target – Load Application**. The application program is stored in the AC 80 RAM, which is also where it is executed.

The **Target – Save in PROM** command creates a back-up of the application program to User FLASH PROM. On power-down, reset, or restart, the application program is restored to the RAM and initialised. Depending on the value of PM825 element parameter STARTMOD, the application program will either start automatically or remain blocked until manually deblocked.

## *AC 80 NCB System Program*

The NCB system program consists of the AMC boot program, NCBOS, and the AMC table of the AC 80.

### *AMC Boot Program*

The AMC boot program resides in a PROM on a socket. It receives the NCB software upon downloading and stores it in non-volatile FPROM.

### *NCBOS*

The NCBOS consists of

- AMCOS operative system, including routing
- Communication support for DriveBus, fieldbus adapters and Special I/O.

The NCBOS automatically adapts to communication configured in the application program in the CPU.

Upon downloading, the NCBOS is stored in non-volatile FPROM and started automatically. The NCBOS can be updated by downloading a new revision; this overwrites the previous NCBOS revision.

On power-down, reset, or restart, the NCBOS in FLASH PROM is copied to RAM and initialised.

### *AMC Table*

The AMC table of the NCB contains variables and parameters which can be accessed by the Drive*Window* and Drive*Debug* tools. Parameter values are saved to non-volatile FPROM and restored upon NCB reinitialisation.

## AC 80 Software Support on PC

The AC 80 software support on the PC can be divided into CPU support and NCB support.

Follow the installation instructions included with each software package.

### AC 80 CPU Support

CPU support requires an RS-232 serial cable between a COM port of the PC and the Service port of the AC 80.

AC 80 CPU support includes:

- AC 80 Loader
- AdvaBuild for Windows (not included with AC 80 deliveries; must be ordered and installed separately)
- AC 80 libraries
  – Contain the PC and database (DB) elements.

*AC 80 Loader*

The AC 80 loader downloads the PROM_080.IMG file. This file contains the current base software.

*AdvaBuild*

The AdvaBuild for Windows software package contains the Application Builder (APB), Function Chart Builder (FCB), and Bus Configuration Builder (BCB) tools. Several versions (but not revisions) of each tool can be installed on the same PC.

The Application Builder is used for
– creating and modifying projects, or nodes for the AC 80
– invoking the Type Circuit Editor
– invoking the FCB and the BCB
– defining the location of the AC 80 on the AF 100 bus
– selection of AC 80 library version
– selection of required options.

The Function Chart Builder is used for
– creating and modifying application programs
– downloading and saving the application program
– displaying and forcing application program variables (in on-line mode)
– debugging and changing the application program (in on-line mode).

The application program exists on the FCB tool as target code and/or AMPL source code. The source code can be created from target code and vice versa.

The Bus Configuration Builder is used for
– getting an overview of targets and messages on the AF 100
– supporting AdvaCommand.

*AC 80 Libraries*

These libraries include PC and database (DB) elements. The PC and DB element libraries are delivered in one package including options. The libraries can be installed together with AdvaBuild. It is also possible to install them later on using the Application Builder tool.

Type circuits are made available to the application programs by copying them to the directory C:\TCLEV1. The user can also create type circuits using the Type Circuit Editor of the Application Builder.

PC and DB element options are made available for application programming by selecting the respective option in the Application Builder. Also note that the backtranslation of the source code will fail if the application program contains unselected options.

The options are as follows:

| Option | Description |
|---|---|
| APCELEM | Install if the application program has APC2-specific PC elements. |
| EVENT | Install if the application program uses Event Send functions. |
| MODBUS | Install if the application program uses Modbus (MultiVendor) communication on the Panel/Printer Link (Ch2). |
| TOOLBOX | Install if the application program has special tool PC elements. |

### *AC 80 NCB Support*

NCB support requires a fibre optic link between the PC and the AC 80 (Tools Link). For this, a laptop PC must be equipped with a PCMCIA/DDCS interface (type NPCM-xx), whereas a desktop PC must be equipped with an ISA/DDCS adapter (NISA-xx).

AC 80 NCB support includes:

- NCB Loader
- Drive*Debug* PC tool.

#### *NCB Loader*

The NCB loader downloads the NCBOS to the NCB board of the AC 80. The loader is started through a shortcut (Windows 95/NT) or a .PIF file (Windows 3.1). The shortcut matching the PC type and selected fibre optic channel should be used.

The files to be loaded are AMC1.ABS and AMC1.CLD. They are specific to the NCBOS version and revision. The .BAT, .EXE and dummy files included are needed for correct operation of the loader and should not be modified in any way.

*Troubleshooting Note for Windows NT users:* If the load starts normally but stops during FLASH PROM initialisation, briefly press the INIT button on the AC 80.

#### *DriveDebug*

Drive*Debug* (DRIDEB) is a Windows-based diagnostic tool for the AC 80, and it is delivered with every AC 80 software package. Several Drive*Debug* versions can be installed on the same computer. Before running Drive*Debug*, the PC must be equipped with a properly installed PCMCIA/DDCS or ISA/DDCS adapter (see above).

The Drive*Debug* User's Manual is included in the AC 80 Software Package (directory **Drideb**) as DRIDEB.DOC.

# Chapter 4 – Programming the AC 80

## Overview

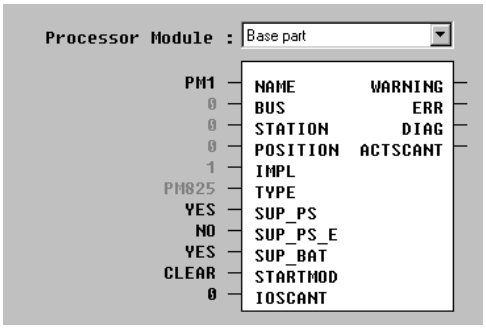
This chapter gives information on writing the application program of the AC 80. It is assumed that the reader is familiar with the AdvaBuild for Windows software suite (especially the Function Chart Builder), as it is the principal tool for application programming.

The chapter includes basic examples of how the AC 80 and its input and output channels are set up in the application program.

## The PM825 Element

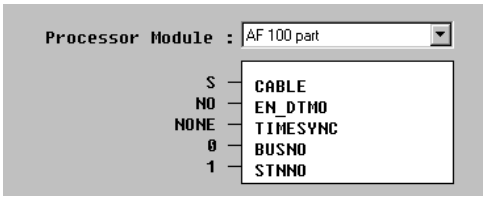
The PM825 database element is the basic configuration element for the AC 80. A detailed description of the terminals of the PM825 element is given in the *AC 80 PC Elements Reference Manual,* under the section *DB Element Descriptions.* Some key terminal settings are discussed below.

### Base Part Terminals



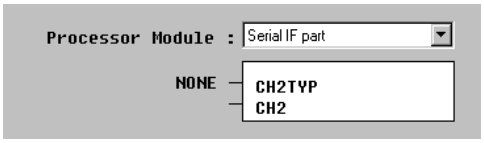

| | |
|---|---|
| NAME | Max. 20 characters. |
| SUP_PS | Supervision of redundant power supplies. Set to YES if redundant power supply connection used. |
| SUP_BAT | Battery supervision. |
| STARTMOD | Starting mode after power-up:<br>CLEAR = Start application program automatically at power-up<br>BLOCKED = Application program blocked until deblocked from FCB or Drive*Window.* |
| IOSCANT | I/O scanner cycle time in milliseconds. |

### AF 100 Part Terminals




| | |
|---|---|
| CABLE | AF 100 cable connection type.<br>(S = Single cable; R = Redundant cabling) |
| TIMESYNC | Time synchronisation selector. One of the AF 100 stations should be set to MASTER, while all others should be set to SLAVE or NONE. |
| BUSNO | AF 100 bus number. |
| STNNO | AC 80 station number on the AF 100 bus. The value must match the hardware address setting on the AC 80 unit. |

### Serial IF Part Terminals




| | |
|---|---|
| CH2TYP | Communication type selection for the AC 80 Panel/Printer link (Ch2).<br>NONE = No devices connected.<br>PANEL = CDP 80, Printer. (AC 80 acts as Master.)<br>MVC* = MultiVendor external device (Master or Slave).<br>*Requires the installation of the optional Embedded Modbus elements. |
| CH2 | Name of corresponding MVICHAN element. (For MVC communication only.) |

## Control of Drives through Optical ModuleBus

ModuleBus has electrical and optical interfaces which are logically the same bus. A maximum of twelve I/O modules can be connected to the electrical ModuleBus. Further twelve I/O modules or drives can be connected to the optical ModuleBus link. A TB810 (10 Mbit/s optical components) or TB811 (5 Mbit/s optical components) Optical Port is required for the use of optical ModuleBus.

### PC Section

Optical ModuleBus communication does not require any PC elements in the application program. Thus communication is handled by DB elements. Transmitted data can be collected together using the Move function blocks in the PC section, and then connected to DB elements.

### DB Section

Inside the DB section, it is possible to control both drive types (ACS 600 SingleDrive [called “Standard Drive” in this context] and ACS 600 MultiDrive) as well as I/O modules on ModuleBus. All connected equipment require their own DB element of a certain type. The DB elements to be used for ACS 600 SingleDrive on Optical ModuleBus are DRIDS and DRISTD, while the corresponding elements for ACS 600 MultiDrive are DRIDS and DRIENG.

The DB elements for S800 I/O modules are the same for both Optical and Electrical ModuleBus, the only difference being the address settings of the elements. Refer to the *Electrical ModuleBus* section later in this chapter.

## Configuration of DB Elements for ACS 600 Standard Drive

*DB Elements*

The ACS 600 Standard Drive requires two types of DB elements, DRIDS and DRISTD.

The DRIDS DB element is used for the configuration of transmitted and received datasets. Two DRIDS elements can be configured for one Standard Drive.

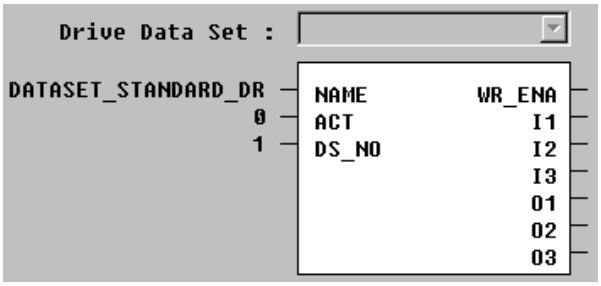



*Figure 4-1 DB element DRIDS for ACS 600 Standard Drive.*

DRIDS has three terminals (I1, I2 and I3) for transmitting data to the drive and three terminals (O1, O2 and O3) for receiving data from the drive. The DS_NO terminal defines the datasets number selected for transmit and receive. (One dataset includes three integers.) **WR_ENA must be set to 1** (by a connection from the PC section) to enable dataset writing.

The DRISTD element is used for addressing the drive, reading basic information from it, and connecting the DB elements of a drive (DRIDS and DRISTD) together.

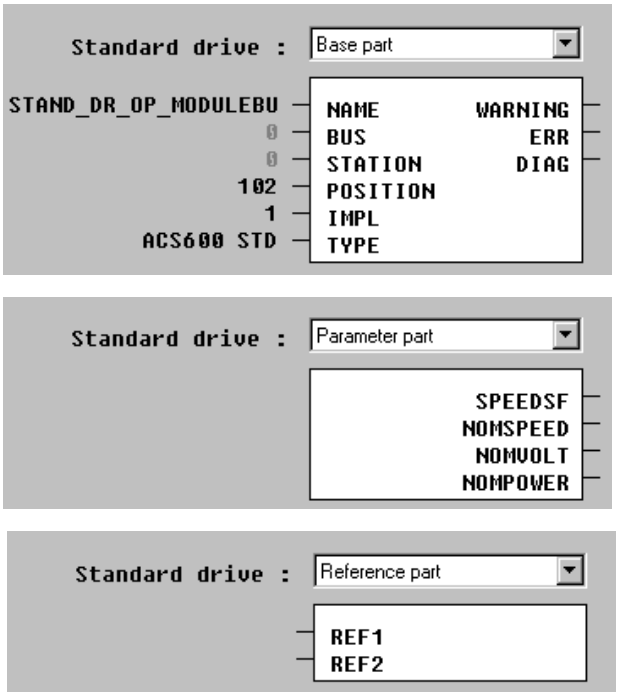



*Figure 4-2 Settings of the DB element DRISTD.*

The DRISTD element has three different parts: Base, Parameter and Reference parts.

The Base part has terminals for drive position (i.e. address on the Optical ModuleBus) and drive type specification. The drive position setting corresponds to drive parameter 70.01.

The Parameter part is used for reading basic information from the drive.

The Reference part is used for specifying the DRIDS elements that are to be used with the DRISTD element.

All output terminals of the Base, Parameter and Reference parts can be connected to the PC section of the application program and measured there.

*Essential Settings for ACS 600 Standard Drive*

Note that only the user-adjustable settings are represented here.

**DRIDS**

| | |
|---|---|
| NAME | Max. 20 characters, e.g. dataset_StdDrive |
| ACT | 1 |
| DS_NO | Dataset number (1 or 3) |
| WR_ENA | 1 (Must be forced by a connection from the PC section) |

**DRISTD**

Base part:

| | |
|---|---|
| NAME | Max. 20 characters, e.g. STD_DR_OP_MODULEBUS |
| POSITION | 100 + address of the drive. **See below.** |
| IMPL | 1 |
| TYPE | ACS 600 STD |

Defining the value of POSITION:

| Position on Optical ModuleBus | Setting of drive parameter 70.01 | DRISTD POSITION setting (100 × Cluster + Position) |
|---|---|---|
| 1 | 17 | 101 |
| 2 | 18 | 102 |
| 3 | 19 | 103 |
| • • • | • • • | • • • |
| 12 | 28 | 112 |

Reference part:

| | |
|---|---|
| REF1 | Max. 20 characters, e.g. dataset_Standard_DR |
| REF2 | Max. 20 characters |

## Configuration of DB Elements for ACS 600 MultiDrive

*DB Elements*

The ACS 600 MultiDrive requires two types of DB elements, DRIDS and DRIENG.

The DRIDS DB element is used for the configuration of transmitted and received datasets. 1 to 10 DRIDS elements can be configured for the ACS 600 MultiDrive.

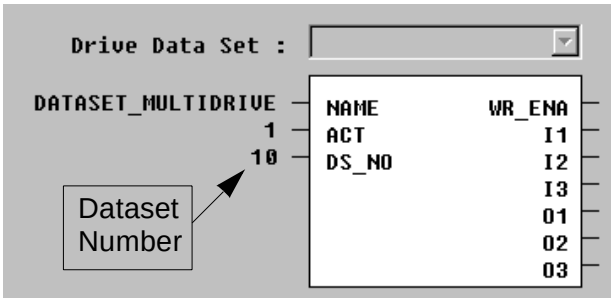



*Figure 4-3 DB element DRIDS for ACS 600 MultiDrive.*

DRIDS has three terminals (I1, I2 and I3) for transmitting data to the drive and three terminals (O1, O2 and O3) for receiving data from the drive. The DS_NO terminal defines the datasets number selected for transmit and receive. (One dataset includes three integers.) **WR_ENA must be set to 1** (by a connection from the PC section) to enable dataset writing.

DRIENG is used for addressing the drive, reading basic information from it, and connecting the DB elements (DRIDS and DRIENG) of the drive together.

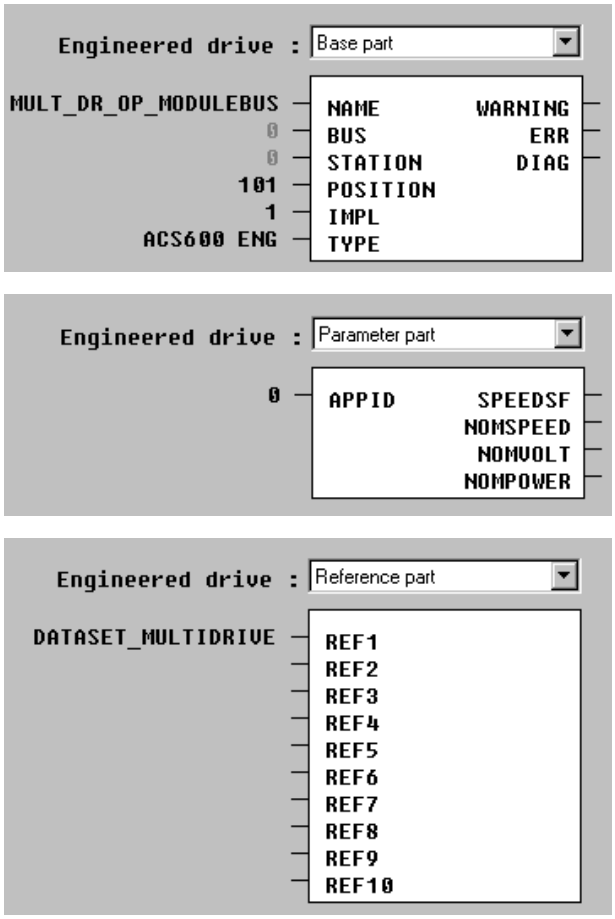



*Figure 4-4 Settings of the DB element DRIENG.*

The DRIENG element has three different parts: Base, Parameter and Reference parts.

The Base part has terminals for drive position (i.e. address on the Optical ModuleBus) and drive type specification. The drive position setting corresponds to drive parameter 70.01.

The Parameter part is used for reading basic information from the drive.

The Reference part is used for specifying the DRIDS elements that are to be used with the DRIENG element.

All output terminals of the Base, Parameter and Reference parts can be connected to the PC section of the application program and measured there.

*Essential Settings for ACS 600 MultiDrive*

Note that only the user-adjustable settings are represented here.

**DRIDS**

| | |
|---|---|
| NAME | Max. 20 characters, e.g. dataset_MultiDrive |
| ACT | 1 |
| DS_NO | Dataset number (10, 12, 14, ..., 32) |
| WR_ENA | 1 (Must be forced by a connection from the PC section) |

**DRIENG**

Base part:

| | |
|---|---|
| NAME | Max. 20 characters, e.g. MULT_DR_OP_MODULEBUS |
| POSITION | 100 + address of the drive. **See below.** |
| IMPL | 1 |
| TYPE | ACS 600 ENG |

Defining the value of POSITION:

| Position on Optical ModuleBus | Setting of drive parameter 70.01 | DRIENG POSITION setting (100 x Cluster + Position) |
|---|---|---|
| 1 | 17 | 101 |
| 2 | 18 | 102 |
| 3 | 19 | 103 |
| • • • | • • • | • • • |
| 12 | 28 | 112 |

Parameter part:

| | |
|---|---|
| APPID | 0 |

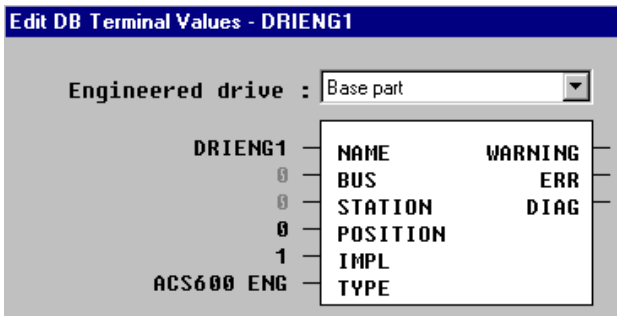
Reference part:

| | |
|---|---|
| REF1 | Max. 20 characters, e.g. dataset_MultiDrive |
| REF2 | Max. 20 characters |
| • • • | • • • |
| REF10 | Max. 20 characters |

***Activation*** The DRIDS element is activated by setting the ACT and WR_ENA terminals to 1. (WR_ENA is set to 1 by a connection from the PC section.)

The DRIENG and DRISTD elements do not need activation.

***Testing*** The DRISTD and DRIENG DB elements have two diagnostic terminals for checking the status of the link. The ERR (Error) terminal indicates fatal errors, the WARNING terminal indicates non-fatal errors. If these terminals are connected to the PC section of the application, they can be measured using the monitor function of FCB.



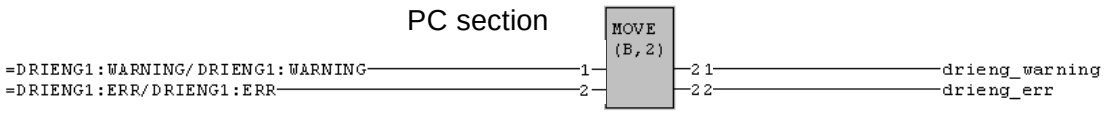
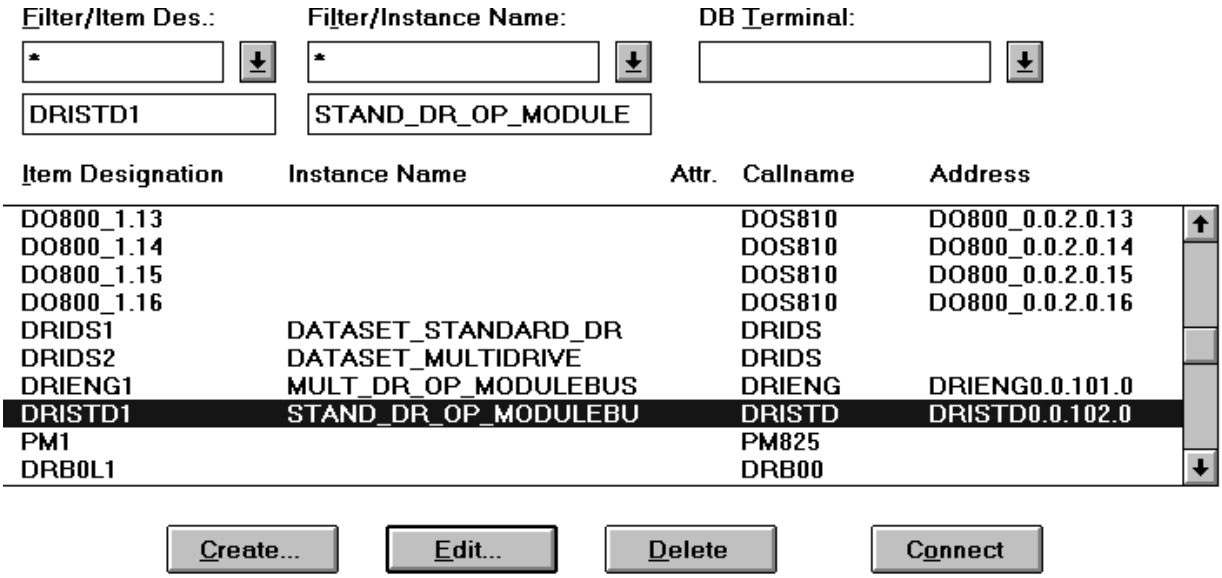




*Figure 4-5 Connecting the WARNING and ERR terminals to the PC section (ACS 600 MultiDrive depicted).*

***Example:***
***ACS 600 MultiDrive***
***on Optical ModuleBus***



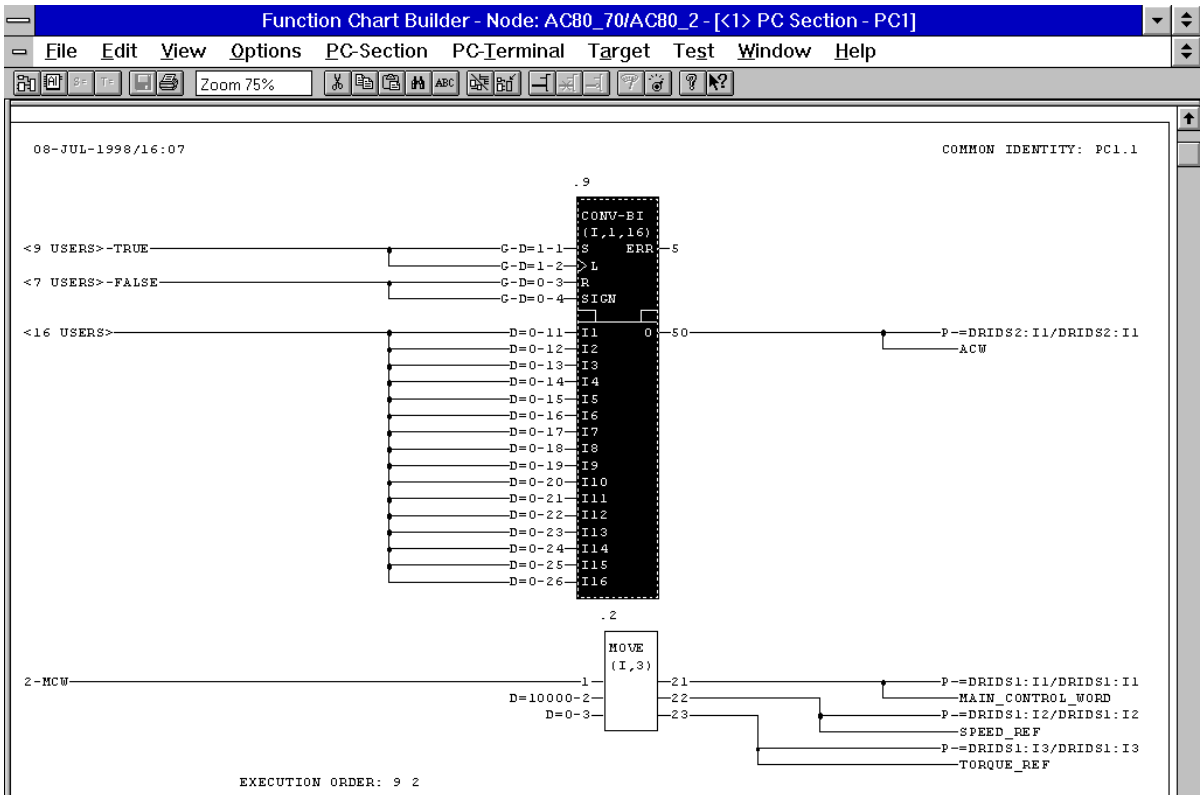




*Figure 4-6 PC and DB sections of the application program.*

## *Control of Drives through DriveBus*

DriveBus has a fibre optic DDCS-protocol interface. A maximum of twelve drives (or other NAMC-based units) can be connected to DriveBus by using NDBU-85 or NDBU-95 branching units.

### *DB Elements*

The DRB0L1 database element activates the drive node(s) and defines an area called the *drive buffer* for each. The drive buffer contains the records that are used for transmitting and receiving buffers for cyclic messages.

The DRB0L1 element must be defined in the application prior to the PC elements.

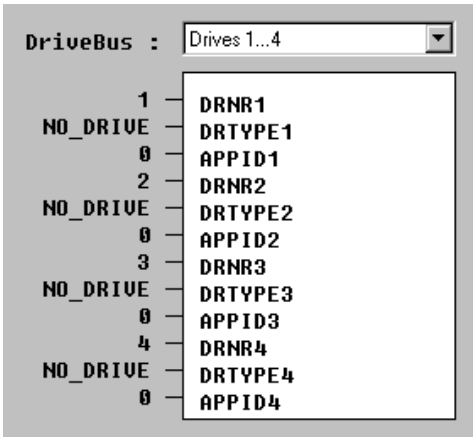



*Figure 4-7 The DRB00 DB element.*

### *PC Elements*

The ACSRX (DRive TRAnsmit and DRive RECeive) element is used for sending and receiving data sets. Data sets consist of three 16-bit words, called data words. The number of data sets supported by the drive is explained in the drive manuals, as is the coding and scaling of the individual data words.

The ACSRX element uses only the cyclic message types supported by the DDCS protocol used by DriveBus. The source for the received data is selected via an element input parameter, specifying the drive number and signal index (dataset number). Consult the drive manuals.

During normal operation, possible ACSRX overload is detected.

---

***Note:*** Ensure that the program block containing the ACSRX element is executed frequently enough not to cause a communication timeout error.

---

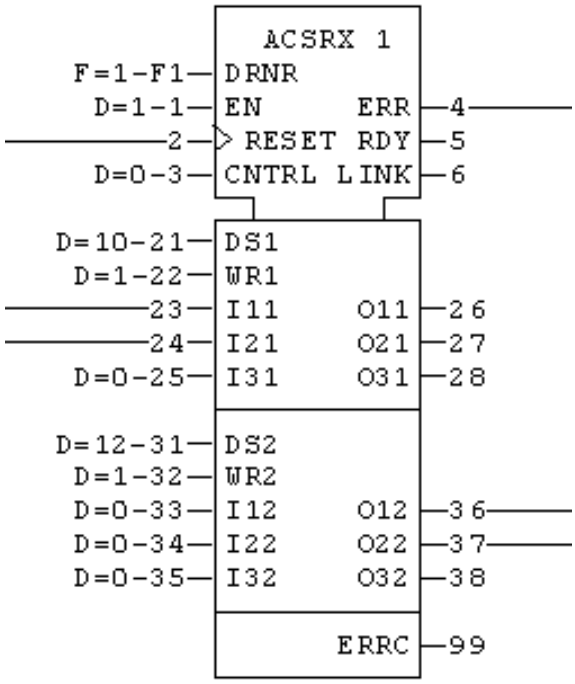



*Figure 4-8 The ACSRX PC element.*

***Essential Settings*** Each drive on the DriveBus link must have an individual address in the range of 1 to 12. The address – set with Parameter 70.01 – corresponds to the DRNR setting in the DB and PC elements below.

For the DB and PC elements, the following settings are required:

**DRB00**

| | |
|---|---|
| DRTYPEx<br>(x = 1 to 12) | ACS600, AMC_classic, AMC_2, DSU_station, TSU_station, NO_DRIVE |

**ACSRX**

| | |
|---|---|
| DRNR | 1 to 12 (Corresponds to drive address parameter 70.01) |
| EN | 1 |
| RESET | 0 |
| CNTRL | 1 |
| DS1 | Number of data set (10 to 32) |
| WR1 | 1 |
| I11 | Transmit integer |
| I21 | Transmit integer |
| I31 | Transmit integer |

The settings are similar for the ACS 600 Standard Drive, with the exception of the available dataset numbers.

***Activation*** The ACSRX element starts to send datasets to the drive when the WRx terminal is set to “1”.

***Testing*** When the hardware part has been installed correctly it is possible to test the communication via the link. The measurements can be carried out using the FCB program. ACSRX has one terminal (ERR) which indicates a fatal error on the link. (The value of “0” denotes “no error”, “1” corresponds to “error”.) The reason for the error is given by another terminal (ERRC) which produces an error code. The codes are listed in the *AC 80 PC Elements Reference Manual.*

### *Example: ACS 600 MultiDrive on DriveBus*

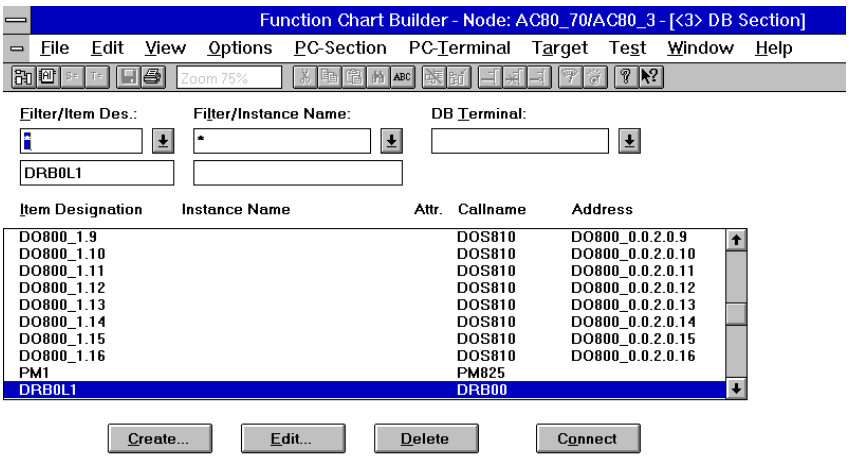



*Figure 4-9 The DB elements library.*

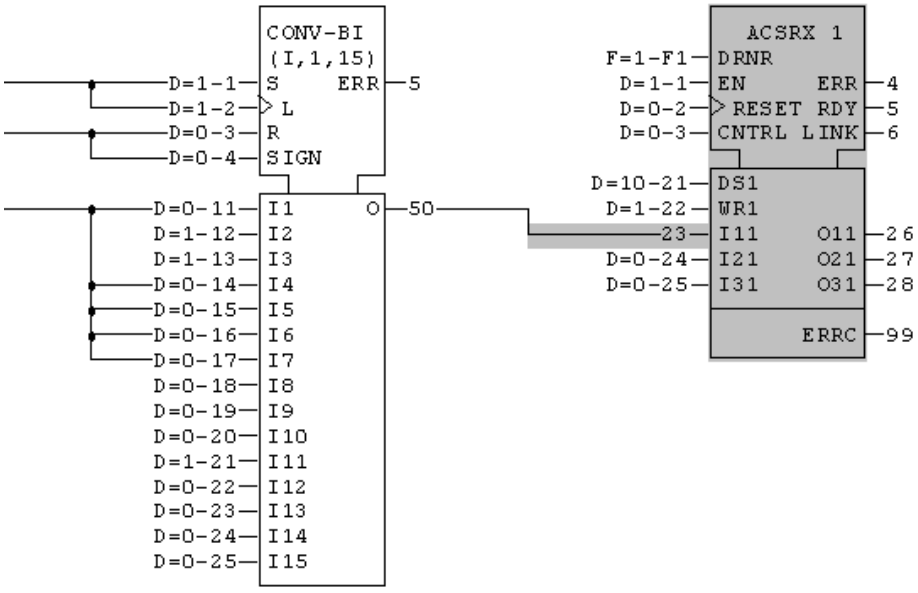



*Figure 4-10 The PC section.*

## *Configuring the Electrical ModuleBus*

As shown in Chapter 2, S800 I/O modules can be connected directly on the AC 80 Electrical ModuleBus, or in I/O clusters via Optical ModuleBus and TB820 ModuleBus modems.

S800 I/O module configuration data is set up in DB elements.

### *DB Elements for S800 I/O Modules*

Each I/O module on the bus must have a dedicated DB element. The element is selected according to the module type (e.g. DI810). The terminal values of this element define e.g. the module position on the bus. When the element is created, the inputs and output channels of the I/O module are displayed as subordinate elements (e.g. DI800_1.1). These are, in turn, connected to the PC section of the application program by the programmer.

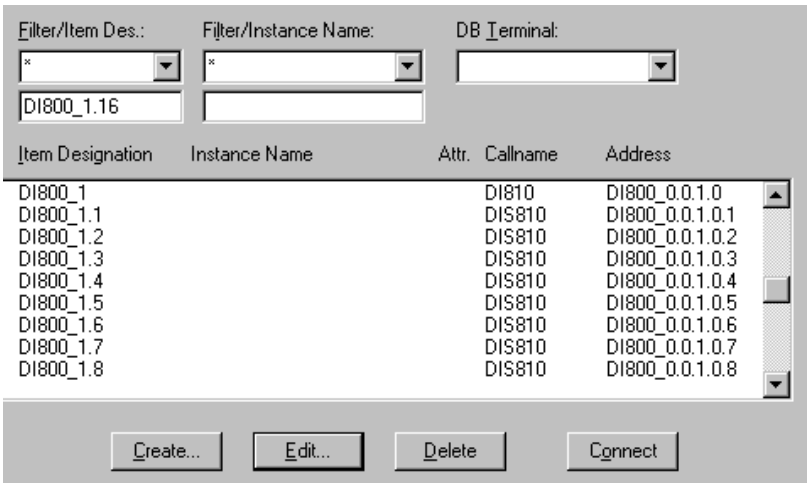



*Figure 4-11 A DI810 element with its subordinate elements.*

*Item Designation:* **_1** refers to the first installed S800 digital I/O module.

*Instance Name:* User-definable (taken from the NAME terminal).

*Callname:* Module type.

*Address (DI800_0.0.**2**.0.**16**):*
**2** refers to position (1 to 12); **16** is the number of the input/output (in this case, 1 to 16).
*Address (DI800_0.0.**101**.0.**1**):*
**101** refers to cluster 1, position 1 (max. 712 = cluster 7, position 12).

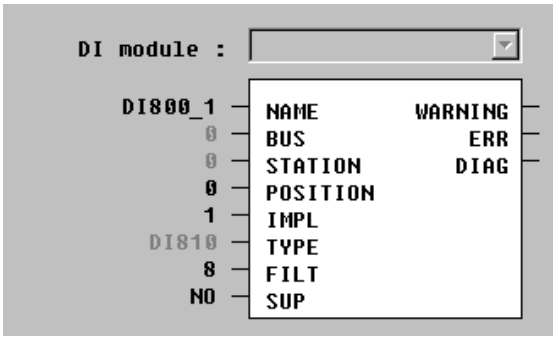



*Figure 4-12 Terminal value settings of a DI810 DB element.*

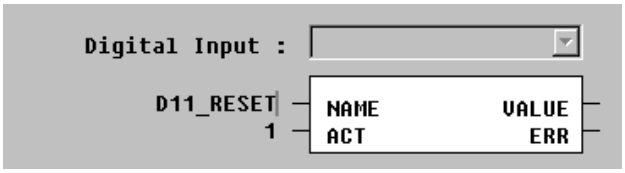
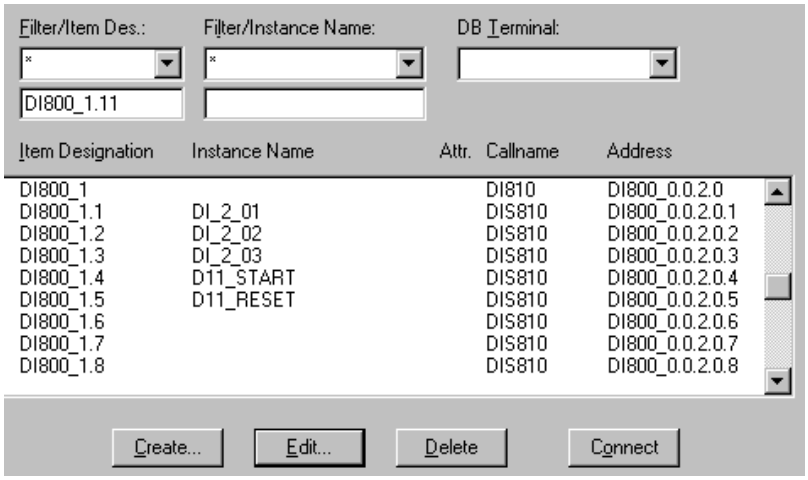



*Figure 4-13 Terminal value settings of a subordinate element (DI810_1.11 depicted). Each subordinate element, i.e. input/output channel, can be given a descriptive instance name by the programmer.*

The input/output channel is active when the subordinate terminal ACT is set to 1 (default setting). If the channel is not active, a connection to the PC section of the application program cannot be made.

In the figure below, five terminals have been named and connected to a MOVE element in the PC section.

DB section




PC section

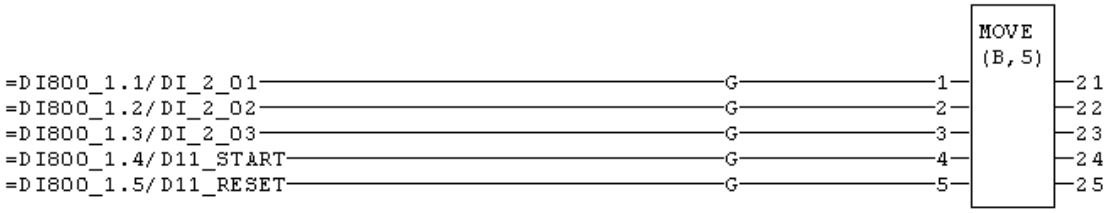



*Figure 4-14 Connection of the subordinate elements of an S800 I/O module element to the PC section of the application program.*

### *S800 Analogue Input Modules*

The DB elements for controlling analogue inputs are shown in the table below.

| AI Module | DB Element | Channels | Type |
|---|---|---|---|
| AI810 | AI810 | 8 | 0 to 20 mA, 0 to 10 V |
| AI820 | AI820 | 4 | ± 20 mA, ± 10 V, ± 5 V |
| AI830RTD | AI830 | 8 | for PT100, Cu10, Ni100, Ni120 |
| AI835 | AI835 | 8 | for Thermocoupling, mV |

### *S800 Analogue Output Modules*

The DB elements for controlling analogue outputs are shown in the table below.

| AO Module | DB Element | Channels | Type |
|---|---|---|---|
| AO810 | AO810 | 8 | 0 to 20 mA, 0 to 10 V |
| AO820 | AO820 | 4 | ± 20 mA, ± 10 V, ± 5 V |

### *S800 Digital Input Modules*

The DB elements for controlling digital inputs are shown in the table below.

| DI Module | DB Element | Channels | Type |
|---|---|---|---|
| DI810 | DI810 | 16 | 24 V d.c. |
| DI820 | DI820 | 8 | 120 V a.c. |
| DI821 | DI821 | 8 | 230 V a.c. |

### *S800 Digital Output Modules*

The DB elements for controlling digital outputs are shown in the table below.

| DO Module | DB Element | Channels | Type |
|---|---|---|---|
| DO810 | DO810 | 16 | 24 V d.c. |
| DO820 | DO820 | 8 | 230 V (relay) |

### *Essential Terminal Settings*

Note that only the user-adjustable settings are represented. (The table also includes the output terminals of the elements.) For more details, see the *AC 80 PC Elements Reference Manual*.

| **Input Terminals for S800 I/O Database Elements (in Alphabetical Order)** | |
|---|---|
| ACT | **ACT**ive: 0=Spare, 1=Active |
| CJC | **C**old **J**unction **C**ompensation (AI835) |
| CONV_PAR | **CONV**ersion **PAR**ameters default conversion for the I/O channels (AI, AO) |
| DEADB | **DEADB**and as a percentage (-1=updated every time) (AI)<br>***Note:*** Lower values provide better accuracy, but lengthen the total execution cycle of the application program |
| FILT | ON/OFF Delay **FILT**er Time in ms (2, 4, 8, 16) (DI) |
| FILTER_P | **FILTER P**arameter (0 to 9500 ms or 10 to 65 s) (AI) |
| FJT | **F**ixed **J**unction **T**emperature (-40.0 to +100.0 °C or -40.0 to +212.0 °F) (AI835) |
| GRIDFREQ | **GRID FREQ**uency (AI) |
| IMPL | **IMPL**emented: 0=Spare, 1=Implemented |
| LIN_CODE | **LIN**earization **CODE** 0=No, 1=Square root (AI810, AI820) |
| NAME | Unique **NAME** of the I/O module/channel, max. 20 characters |
| OSP_CTRL | **O**utput **S**et as **P**redetermined: 0=Keep current value, 1=Set OSP_VAL (AO, DO) |
| OSP_VAL | **OSP VAL**ue if OSP_CTRL is selected (AO, DO) |
| POSITION | **POSITION** on ModuleBus (1 to 12 [Electrical], 101 to 712 [Optical]) |
| SUP | Sensor Power **SUP**ervision: YES=Enable, NO=Disable (DI) |
| TC_TYPE | **T**hermo**C**ouple **TYPE** Both for Celsius and Fahrenheit (AI835) |

| **Output Terminals for S800 I/O Database Elements (in Alphabetical Order)** | |
|---|---|
| DIAG | **DIAG**nostics |
| ERR | **ERR**or indicates fatal configuration or hardware error |
| VALUE | Signal **VALUE** |
| WARNING | **WARNING** indicates a non-fatal error |

### *Control of the Panel/Printer Link*

The elements to be used depend on the communication mode of the link. The mode is selected with the CH2TYP terminal in the Serial IF part of the PM825 database element. See Chapter 2, section *Panel/Printer Connection (Ch2),* and this chapter, section *The PM825 Element – Serial IF Part.*

### *Panel/Printer Link in Panelbus Mode*

The Panelbus mode is selected by setting the CH2TYP terminal of the PM825 DB element to PANEL.

*DB Elements*

The only database element required is PANBUS. It specifies the channel configuration, and there can only be one PANBUS instance on the system. The terminals of PANBUS are divided into Base, Communication and Parameters parts.

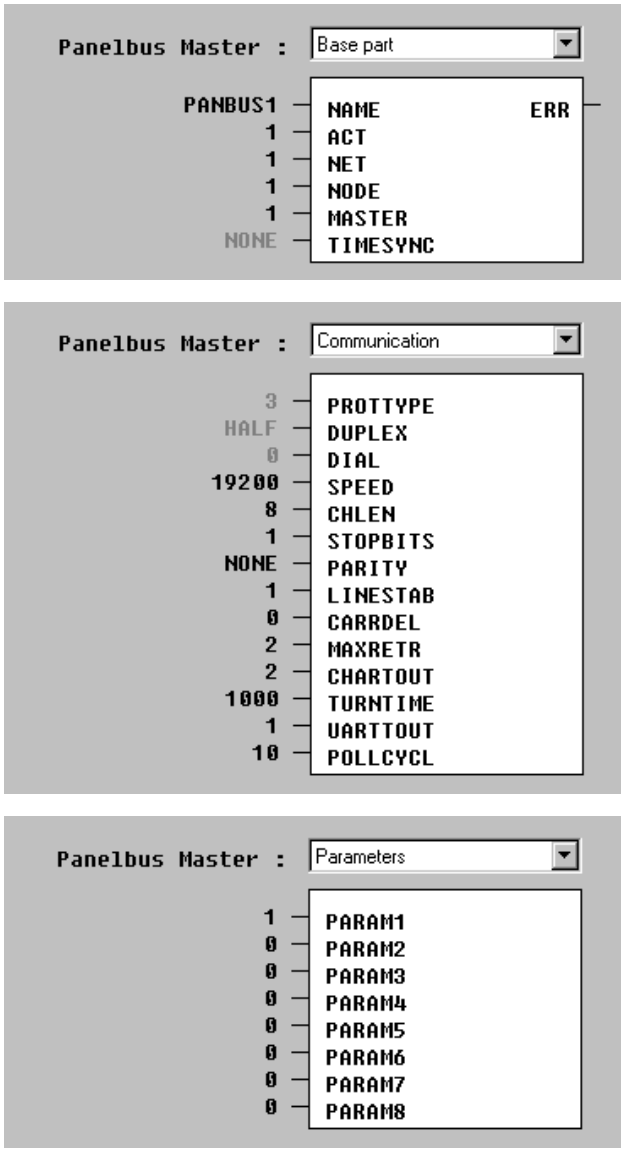



*Figure 4-15 The terminals of the PANBUS element.*

*PC Elements*

Each device on the Panel/Printer link needs to be individually configured in the PC section of the application program.

CDP 80 control panel communication is controlled by the PANC element. (The PANBUS element must have the following terminal values: SPEED: 19200; CHLEN: 8; PARITY: NONE.)

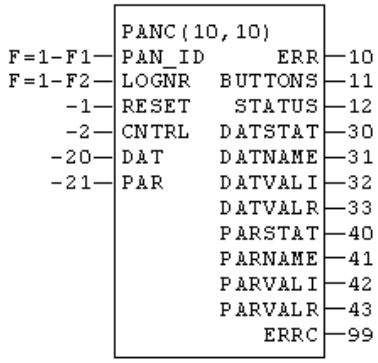
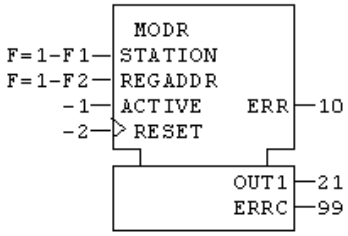
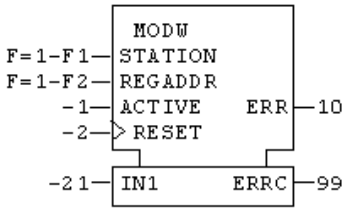



*Figure 4-16 The PANC PC element, used for controlling one CDP 80 Control Panel.*

Other Panelbus devices use the MODR (Modbus Read) and MODW (Modbus Write) elements:




Receive




Transmit

*Figure 4-17 The MODR and MODW PC elements, used for reading data from and writing data to a remote device through the Panel/Printer link.*

*Essential Settings*

Only the user-adjustable settings are represented. (The tables also include the information readable from the output terminals.) For more details, see the *AC 80 PC Elements Reference Manual.*

**PANBUS**

Base part:

| | |
|---|---|
| NAME | Max. 20 characters |
| ACT | 0 = Spare element<br>1 = Active element |
| NET | 1 |
| MASTER | 1 |

Communication:

| | |
|---|---|
| SPEED | Max. 19200 |
| CHLEN | 8 |
| STOPBITS | 1 (Can also be 1.5 or 2) |
| PARITY | NONE |
| LINESTAB | 1 |
| CARRDEL | 0 |
| MAXRETR | 2 (Max 20) |
| CHARTOUT | 2 |
| TURNTIME | 1000 |

**PANC**

| | |
|---|---|
| C1 (Call Parameter) | Number of DATs (0 to 72). |
| C2 (Call Parameter) | 0 = Spare element<br>1 = Active element |
| PAN_ID | Station address of the control panel. |
| LOGNR | ID number of event logger. |
| RESET | 0 |
| CNTRL | See the *AC 80 PC Elements Reference Manual.* |
| DAT | |
| PAR | |

### MODR

| | |
|---|---|
| C1 (Call Parameter) | Number of output pins (1 to 32). |
| STATION | Station number of device. |
| REGADDR | 0…9998 or 0…998 (See the *AC 80 PC Elements Reference Manual).* |
| ACTIVE | 1 |
| RESET | 0 |

### MODW

| | |
|---|---|
| C1 (Call Parameter) | Number of input pins (1 to 32). |
| STATION | Station number of device. |
| REGADDR | 0…9998 or 0…998 (See the *AC 80 PC Elements Reference Manual).* |
| ACTIVE | 1 |
| RESET | 0 |
| SORT_REF | Sort references:<br>NO = References not sorted<br>YES = References sorted in the order B, I, IL, R |

***Panel/Printer Link in MultiVendor Mode***

The MultiVendor mode is selected by setting the CH2TYP terminal of the PM825 DB element to MVC.

---

***Note:*** Use of the MultiVendor mode requires the installation of the optional Embedded Modbus elements. These elements can be installed along with AdvaBuild, or later on using the Application Builder.

---

*PC Elements*

The communication is handled entirely by database elements; no PC elements are required.

*DB Elements*

An MVI channel consists of up to 25 nodes. The MVICHAN database element specifies the channel configuration. The terminals of MVICHAN are divided into Base, Communication and Parameters parts.

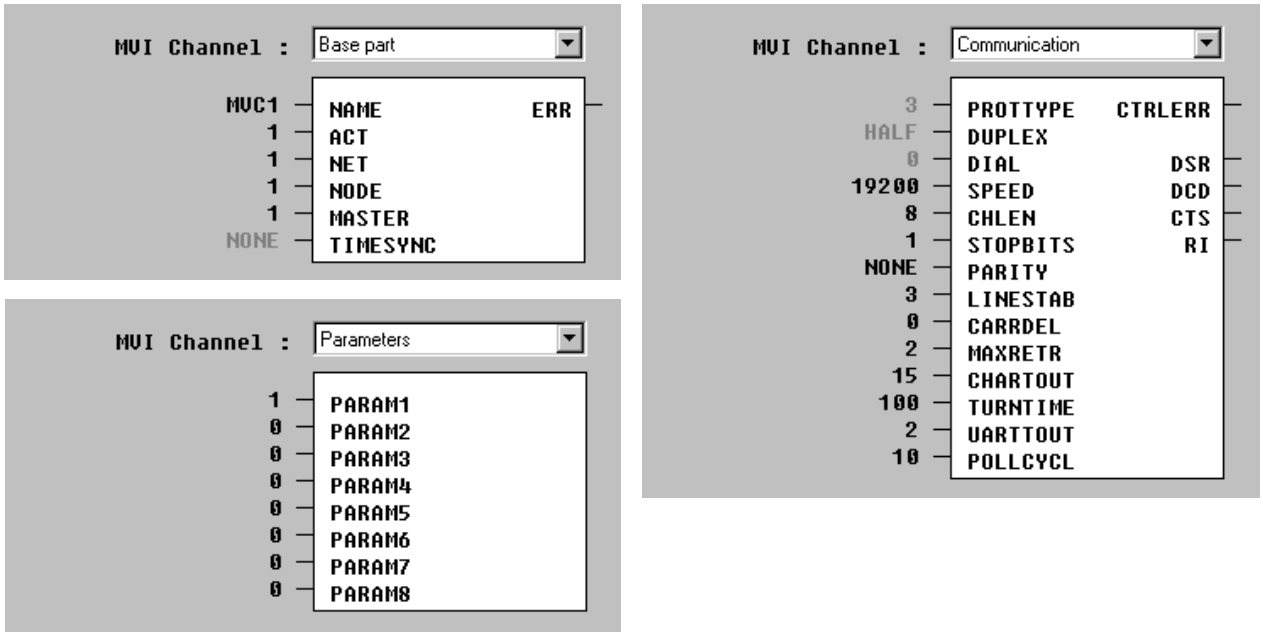



*Figure 4-18 The terminals of the MVINODE element.*

Each node is represented by a DB element of the type MVINODE.

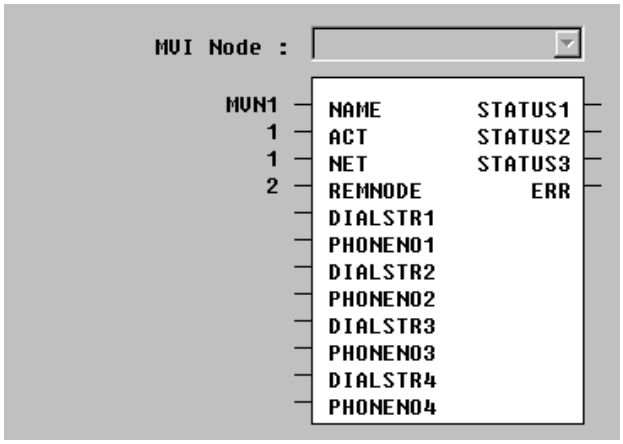



*Figure 4-19 The terminals of the MVINODE element.*

The MVB (MVI Data Block) element specifies one MVI data block. It configures either data transmission or commands for the MVI protocol handler. An MVI data block is a collection of up to 128 DATs of any type.

Creating an MVI data block element automatically creates the required DAT elements. This element has a Base part and nine different Value reference parts. Each Value reference part contains 16 value references.

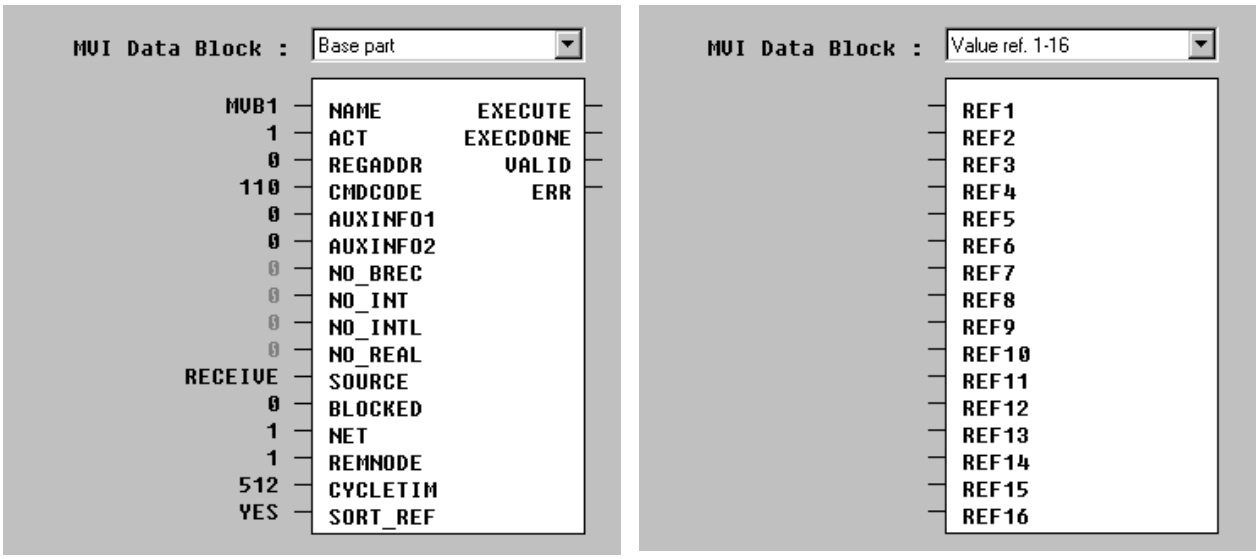



*Figure 4-20 The terminals of the MVB element.*

*Essential Settings*

Only the user-adjustable settings are represented. (The tables also include the information readable from the output terminals.) For more details, see the *AC 80 PC Elements Reference Manual.*

**MVICHAN**

Base part:

| | |
|---|---|
| NAME | Max. 20 characters |
| ACT | 0 = Spare element<br>1 = Active element |
| NET | Network number of MVI channel. |
| NODE | Individual node number of MVI channel. |
| MASTER | MVI channel in slave (0) or master (1) mode. |
| TIMESYNC | Time synchronisation:<br>NONE; MASTER; SLAVE |

**MVINODE**

| | |
|---|---|
| NAME | Max. 20 characters |
| ACT | 0 = Spare element<br>1 = Active element |
| NET | MVI network number. |
| REMNODE | Remote node number.<br>In Master mode: node number of Slave<br>In Slave mode: node number of Master |

**MVB**

| | |
|---|---|
| NAME | Max. 12 characters |
| ACT | 0 = Spare element<br>1 = Active element |
| REGADDR | Register start address in external PLC/RTU.<br>In RCOM: MVB identifier. |
| CMDCODE | Command code to be executed by the MVI protocol handler (protocol-dependent). |
| AUXINFO1 | Auxiliary information 1 (protocol-dependent). |
| AUXINFO2 | Auxiliary information 2 (protocol-dependent). |
| NO_BREC | Number of Boolean records DAT(B). |
| NO_INT | Number of integer records DAT(I). |
| NO_INTL | Number of long integer records DAT(IL). |
| NO_REAL | Number of real records DAT(R). |
| SOURCE | Source. Defines the direction of the data transmission (RECEIVE; SEND). |

| | |
|---|---|
| BLOCKED | Cyclic data transmission:<br>0 = Not blocked<br>1 = Blocked |
| NET | MVI network number used for data block transmission. |
| REMNODE | Remote node number.<br>In master mode: node number of slave.<br>In slave mode: node number of master. |
| CYCLETIM | Defines the cycle time of the protocol command execution in multiples of 100 ms.<br>Alternative values: 0 (no cyclic execution), 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768 |
| SORT_REF | Sort references:<br>NO = References not sorted<br>YES = References sorted in the order B, I, IL, R |

***Activation*** The MVICHAN, MVINODE and MVB elements are activated by setting the ACT terminal to “1”.

***Testing*** The DB element MVICHAN has a diagnostic terminal (ERR) in the Base part for channel status check. The ERR terminal indicates fatal errors. There are also five diagnostic terminals in the Communication part. They are described in the table below.

| | |
|---|---|
| CTRLERR | Indicates any control errors in the modem interface. |
| DSR | Modem signal data set ready. |
| DCD | Modem signal data carrier detect. |
| CTS | Modem signal clear to send. |
| RI | Modem signal ring indicator. |

The DB element MVB has four diagnostic terminals:

| | |
|---|---|
| ERR | Fatal error. |
| EXECUTE | Invokes single execution of the specified protocol handler command when switched from “0” to “1”. |
| EXECDONE | Indicates that the execution invoked by EXECUTE has been done. |
| VALID | Boolean value (identity) for handshaking between MVI and PC program.<br>Receiving MVB:<br>0 = MVB has not been received within CYCLETIM × 3<br>1 = MVB has been updated<br>Sending MVB:<br>0 = MVB has not been sent<br>1 = MVB has been sent |

Inside the PC section of the application program, it is possible to measure the value of a terminal by using the FCB tool. The diagnostic terminals of the DB element are connected to the PC section of the application program as shown below.

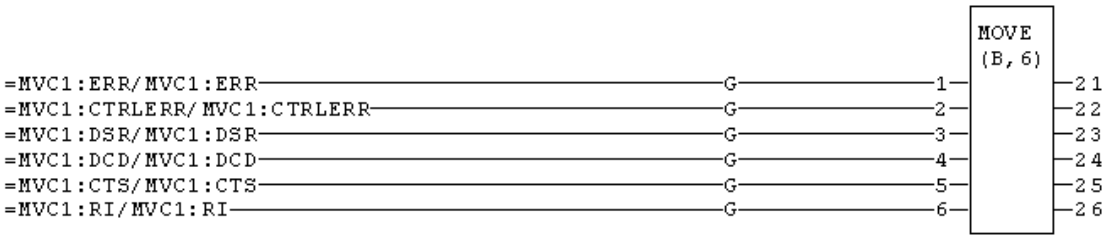



*Figure 4-21 Connecting the diagnostic terminals of the MVICHAN element to the PC section of the application program.*

## *Control of the AF 100 Link*

The AF 100 link provides communication between multiple AC 80 stations. AF 100 is also used for connecting one or several AC 80 units to an external system (such as the AC 110 controller), or for connecting the AC 80 to an APC2.

### *Addressing*

The address for the AC 80 station on the AF 100 link is given in the DB section of the application program. The node (station) number of the AC 80 is defined by the AF 100 part of the DB element PM825. The terminal named STNNO, in the AF 100 part, is used for setting the station number. Its value must match the hardware address setting of the AC 80.

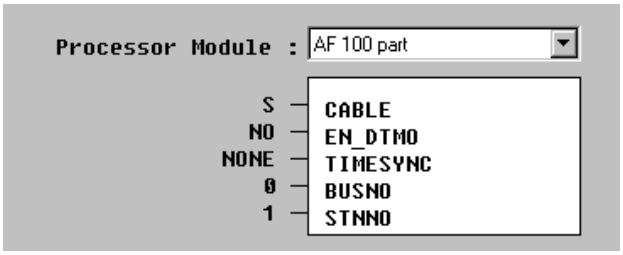



*Figure 4-22 The terminal settings of the AF 100 part of the PM825 database element.*

The CABLE terminal should be set to S (for single-cable bus connection) or to R (for redundant cabling).

The TIMESYNC terminal should be set to MASTER on one station on the AF 100. All other stations should be set to SLAVE (or NONE, if synchronisation is not required).

### *Communication between Advant Controllers*

For the PC section of the application program, the following elements are available: AFREC or MB90REC and AFTRA and MB90TRA.

For AF 100 communication with an APC2 system, see the manual *Function Blocks for APC2.*

### *DB Elements*

The PM825 DB element is the only one needed for AF 100 communication. See above, and the section *The PM825 Element* (page 4-1).

The DSP (DataSet Peripheral) element is used for removing error code 3106 from the error terminal (ERR) of MB90TRA/MB90REC. Without the DSP element, the communication will work but the system will produce an error code.

***PC Elements*** The AFTRA and MB90TRA elements are used for sending data cyclically over the AF 100. The data types are determined by the call parameters; the alternatives are I, IL and R. The transmitted data is updated to the AF 100 bus coupler memory each time the element is executed, and sent onto the bus as set with the SCAN terminal.

The AFREC and MB90REC elements are used for receiving data from the AF 100. The data types are determined by the call parameters; the alternatives are I, IL and R.

Note that the IDENT number on the transmitting and receiving elements must match.

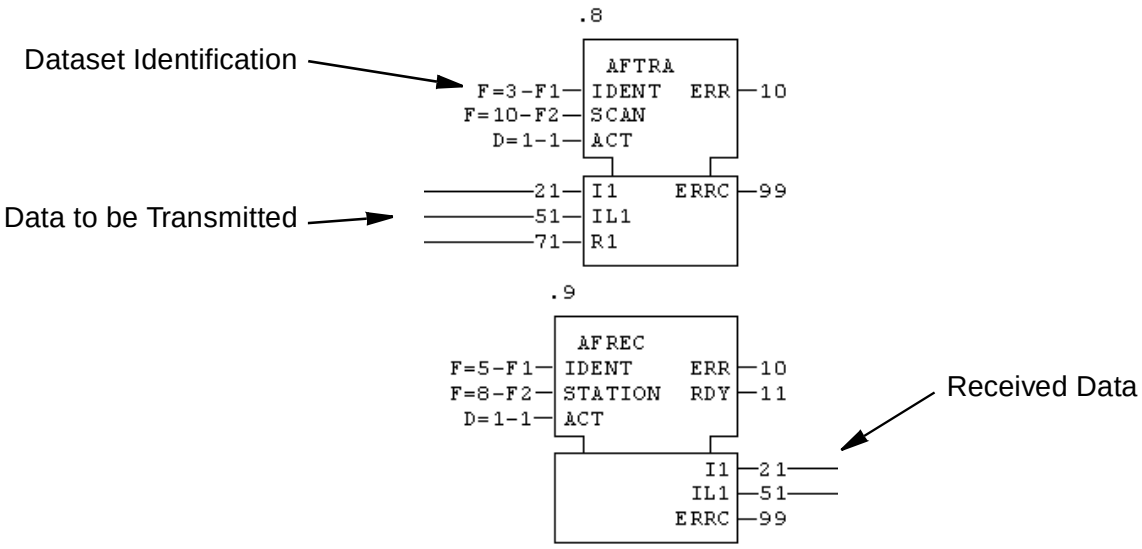



*Figure 4-23 The AFTRA and AFREC PC elements.*

The difference between AFxxx and MB90xxx elements is in the way they handle short integer data. For more information, see the *AC 80 PC Elements Reference Manual.*

***Essential Settings*** Only the user-adjustable settings are represented. For more details, see the *AC 80 PC Elements Reference Manual.*

**PM825**

AF 100 part:

| | |
|---|---|
| CABLE | S (Single) or R (Redundant). |
| EN_DTMO | Enable Double Timeout:<br>NO; YES |
| TIMESYNC | Time Synchronisation:<br>NONE; MASTER; SLAVE |
| BUSNO | 0 |
| STNNO | 1…79 (Must match AC 80 hardware address setting). |

**DSP**

Base part:

| | |
|---|---|
| NAME | Unique dataset name (max. 20 characters). |
| ACT | 0 = Spare element<br>1 = Active element |
| BUS | 0 |
| IDENT | Dataset identification (1…50). Must match the IDENT terminal value in the corresponding PC element. |
| SOURCE | Direction of communication:<br>RECEIVE; SEND |
| STATION | AF 100 station number of the opposite target. |
| CYCLETIM | Transmission interval in milliseconds. |
| SORT_REF | Sort references:<br>NO; YES |

Value references:

| | |
|---|---|
| REF1 | User-definable name of a DAT element. |
| REF2 | User-definable name of a DAT element. |
| • • • | • • • |
| REF8 | User-definable name of a DAT element. |

**DAT**

See the *AC 80 PC Elements Reference Manual.*

**AFTRA/MB90TRA**

| | |
|---|---|
| IDENT | Dataset identification (1…50). |
| SCAN | Transmission interval in milliseconds (1…4096). |
| ACT | 1 |

**AFREC/MB90REC**

| | |
|---|---|
| IDENT | Dataset identification (1…50). |
| STATION | Node number of the transmitter (1…79). |
| ACT | 1 |

***Activation*** The AF 100 part of the PM825 database element does not need activation.

The Base part of the DSP element is activated by setting the ACT terminal to 1.

The DAT elements do not need activation.

The AFTRA, AFREC, MB90TRA and MB90REC elements are activated by setting the ACT terminal to 1.

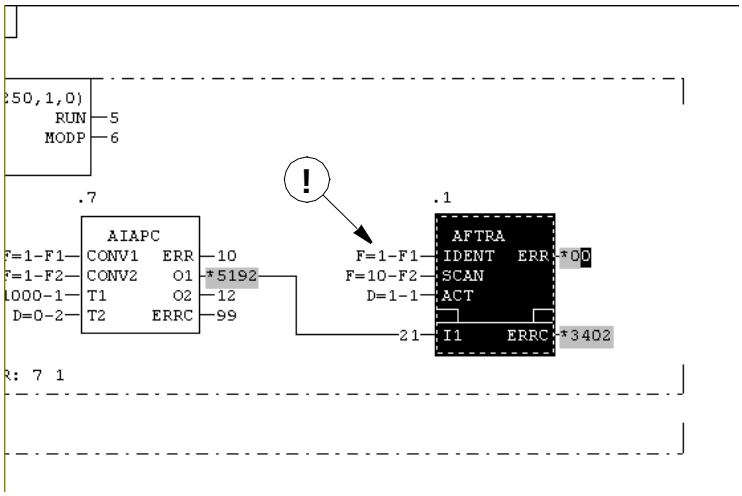
***Testing*** The PM825 element has a WARNING terminal for non-fatal errors and an ERR (Error) terminal for fatal errors.

The Base part of the DSP element has an ERR terminal for fatal errors.

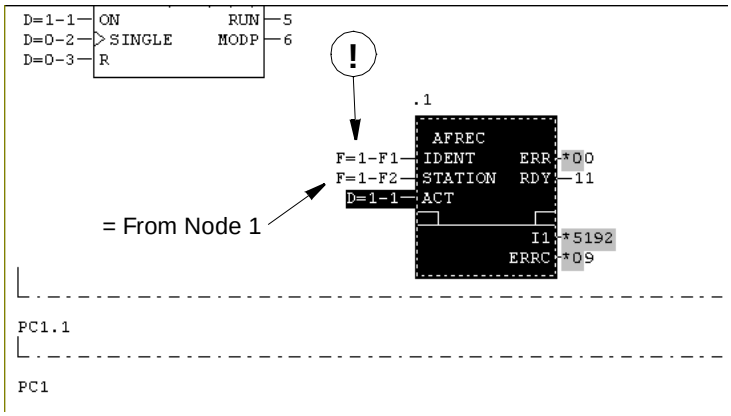
The AFTRA, AFREC, MB90TRA and MB90REC elements have two status output terminals, ERR and ERRC. These terminals indicate a fatal error and the error code respectively.

***Example:***
***AF 100 Communication***
***between AC 80s***

PC Section of Node 1




PC Section of Node 2



### *Control of the Special I/O Link*

The Special I/O link is a DDCS-protocol fibre optic ring that can contain up to eight I/O devices. The sequence of the devices determines the node numbers as shown below.

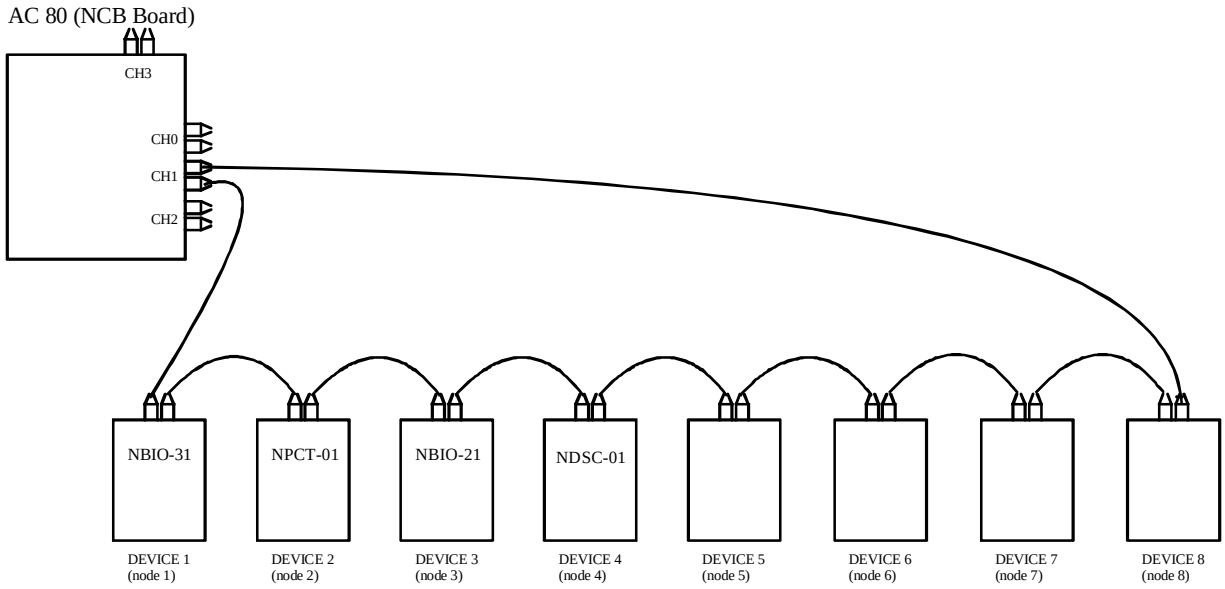



*Figure 4-32 The Special I/O link.*

The terminal values of the I/O devices are accessed by the application program through PC and DB elements. Also note that the system software package of the AC 80 includes type circuits for handling Special I/O devices. For detailed information, refer to the *AC 80 PC Elements Reference Manual.*

***DB Elements*** Each node (I/O device) on the Special I/O link is activated with the DB element NCBIO1. For each node, NCBIO1 defines a buffer containing the records that are used by the link to transmit and receive cyclic messages.

The NCBIO1 element has to be defined in the application prior to any Special I/O link PC element.

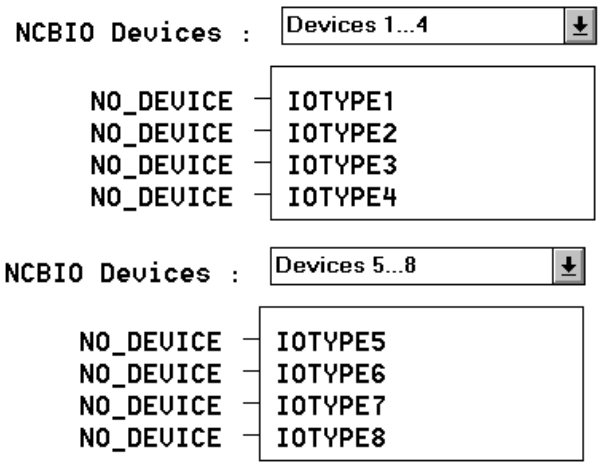



*Figure 4-33 The NCBI01 DB element.*

The type of the Special I/O device is defined by NCBIO1 terminal IOTYPEx (where x = 1 to 8). Note that the first terminal is assigned to Node 1, the second terminal to Node 2 etc.

The following I/O device types are supported:

| Module Type | NCBI01 IOTYPE |
|---|---|
| NBIO-31 | DI/DO_DEVICE |
| NBIO-21 | AI/AO_DEVICE |
| NPCT-01 | COUNTER_DEVICE |
| NDSC-01 | DSU DEVICE |

***PC Elements*** The IORX (Input Output Receive) element is used for sending and receiving datasets. IORX can create different types of cyclic messages supported by the DDCS protocol used in the Special I/O link. The destinations of the transmitted data are selected by the signal index.

The source of the received data is selected via element input parameters. These parameters specify the node number and signal index (dataset number). See the *AC 80 PC Elements Reference Manual.*

Each I/O device can have one up to eight IORX elements in the application program, i.e. the maximum number of IORX elements is 64.

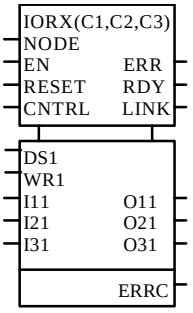



*Figure 4-34 The IORX PC element.*

***Essential Settings***

**IORX**

| | |
|---|---|
| C1 (Call Parameter) | Block number (1 to 8). |
| C2 (Call Parameter) | Number of datasets (1 to 2).<br>(**Note**: 1 recommended for NDSC) |
| C3 (Call Parameter) | Data type (I or IL).<br>(**Note**: I only for NDSC) |
| NODE | Node number (1 to 8). |
| EN | 1 |
| RESET | 0 |
| CNTRL | See the *AC 80 PC Elements Reference Manual.* |
| DS1 | Dataset number (1 to 254).<br>(**Note**: 10 to 32 for NDSC) |
| WR1 | 1 |
| I11 | Transmit integer or long integer. |
| I21 | Transmit integer or long integer. |
| I31 | Transmit integer or long integer. |

**NCBIO1**

| | |
|---|---|
| IOTYPE1 | NO_DEVICE; DI/DO_DEVICE; AI/AO_DEVICE; COUNTER_DEVICE; DSU_DEVICE |
| IOTYPE2 | NO_DEVICE; DI/DO_DEVICE; AI/AO_DEVICE; COUNTER_DEVICE; DSU_DEVICE |
| • • • | • • • |
| IOTYPE12 | NO_DEVICE; DI/DO_DEVICE; AI/AO_DEVICE; COUNTER_DEVICE; DSU_DEVICE |

***Activation***

The IORX element starts to send datasets when the value of terminal WRx is 1.

### *Testing*

After the hardware part is properly installed, it is possible to test the communication. Measurements can be carried out using the FCB program. The OIRX element has an ERR terminal for indicating fatal errors on the link (1 = error, 0 = no error). The reason for the error is indicated by the ERRC terminal; the error codes are listed in the *AC 80 PC Elements Reference Manual.*

### *Example: DSU (Diode Supply Unit) on the Special I/O Link*

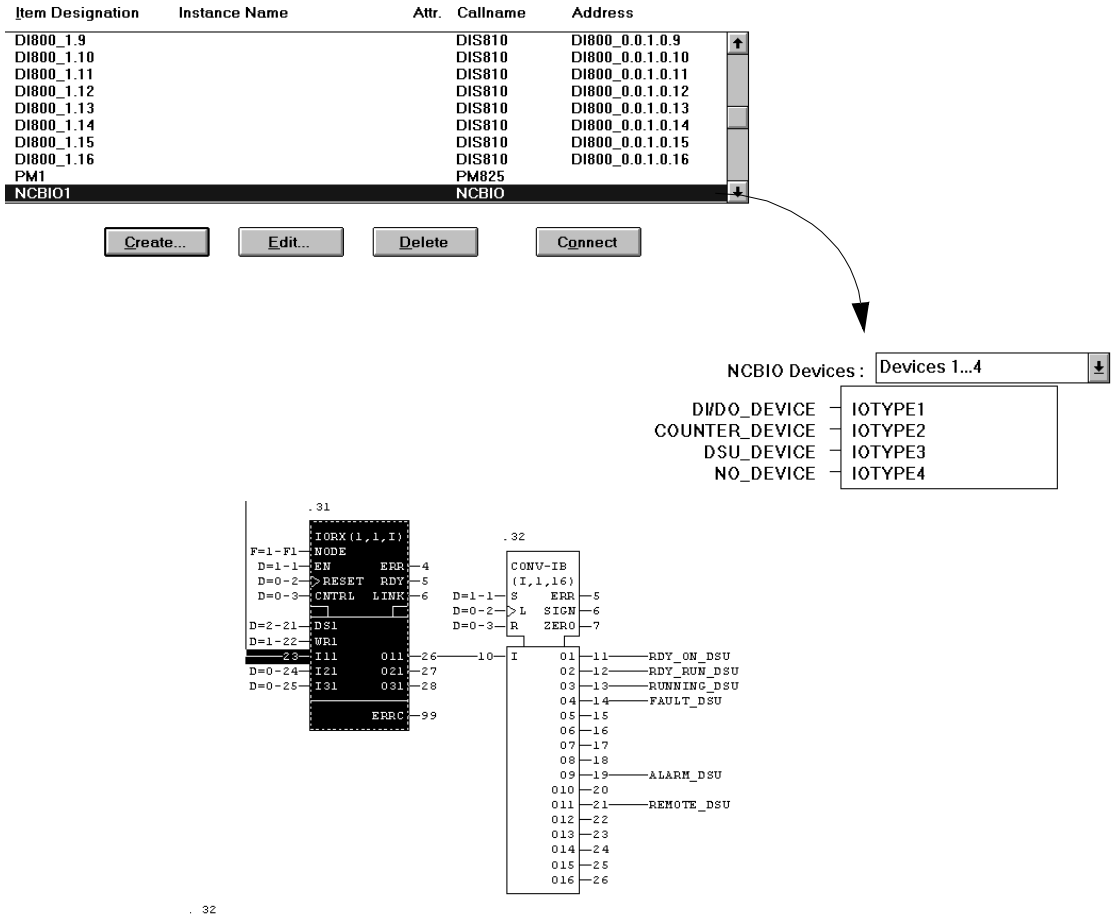



*Figure 4-35 The DB and PC sections for communication with a Diode Supply Unit.*

### *Control of the Fieldbus Adapter Link*

The programming of the Fieldbus Adapter Link is detailed in the protocol-specific manuals, such as *Use of PROFIBUS-DP Protocol in Advant Controller 80.*

# Chapter 5 – Diagnostics

## Overview

There are various methods for finding out the reason for unexpected behaviour of the AC 80. These methods are:

- Visual inspection (of the LEDs, for example)
- Using the Function Chart Builder (FCB) tool and its diagnostic reports
- Using dynamic measurements from the PC elements
- Using the Drive*Debug* tool.

## LEDs

The LEDs on the AC 80 give useful information on the working of the system at a glance. The LEDs are even more useful when the tool connections are not working or otherwise not available. (When available, however, the report functions of the tools often give more detailed information than the LEDs.)

---

***Note:*** For LED indications during normal operation, see Chapter 2.

---

### Bus Indicator LEDs

*PC* These LEDs show whether Drive*Debug* is being used (both Rx and Tx are lit).

*Dbus* These LEDs show whether DriveBus is in use, or if any drive or branching unit is responding. Responding drives are indicated by continuous glow, branching units polled are indicated by flashing.

*I/O* These LEDs indicate if the I/O bus of the CPU board is OK.

*FBA* These LEDs monitor fieldbus adapter communication.

Note that the Rx LEDs indicate messages received from the fibre optic links, whereas the Tx LEDs are controlled by the AC 80 itself.

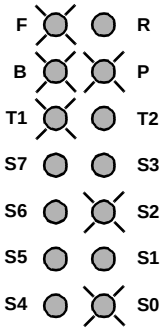
### General Purpose LEDs S0 to S7

When LED S7 is on, LEDs S0 to S6 display a status code (given in Chapter 2).

When the special purpose LED **F** is **on** and **S7** is **off**, an error code is indicated by LEDs S0 to S6 as shown in the table below. The LEDs on the left (S4 to S6) show the higher nibble of the error code, while those on the right (S0 to S3) show the lower nibble.

Error indication examples:

05h (Bus error)




49h (Internal error)

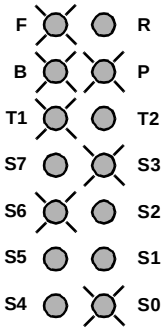



*Table 5-1 S0…S7 fault indications.*

| Code (Hex) | Cause | Remedy |
|---|---|---|
| 05 | Bus error - memory<br>The processor tried to access a nonexistent memory location. This indicates a serious system software error or defective hardware. | Restart CPU and run application again. If error occurs again, replace the CPU module PM820-2. |
| 09 | Stall alarm<br>This is a software problem and indicates that the CPU is not working correctly. It is probably caused by a CPU overload. | Restart the system in STOP MODE.<br>Extend the cycle times of execution units in the PC program or remove one or more execution units, e.g., control modules, and load and deblock the application again. |
| 0A | Memory test error<br>The error code appears during the RAM test, which is performed during system initialization. | Replace the CPU module PM820-2. |
| 0C | Instruction set fault | Replace the CPU module PM820-2 |
| 0D | Interval timer test failed | Replace the CPU module PM820-2. |
| 0F | Bus error test failed<br>This is a hardware problem and indicates a CPU internal bus error. | Replace the CPU module PM820-2. |
| 22 | START MODE selector in the STOP position<br>The START MODE selector on the PM820-2 DB element was in STOP position when the system attempted to restart. | Restart the system with START MODE selector in either the CLEAR or AUTO position. |
| 27 | Insufficient memory<br>The CPU could not start the application due to lack of memory. | Restart the system in STOP MODE. Then remove all loaded but unused options which may consume memory by loading BASE software. Enable only necessary options and restart the system by pressing the INIT push button with the START MODE selector in CLEAR position. |
| 42 | Overload<br>The CPU was not able to run the specified control module. The control module could not be completed within the specified cycle time and was aborted. | Restart the system in STOP MODE. Then reduce the load by extending the cycle times, for example, of control modules in the PC program or remove one or more execution units, e.g., control modules. Load and deblock the application again. |

| Code (Hex) | Cause | Remedy |
|---|---|---|
| 43 | User PROM error<br>This indicates that the memory used for storing the application program could be defective. | Restart the system in STOP MODE. Then reload the application program and try to save it again in PROM.<br>Replace the CPU module PM820-2. |
| 44 | System PROM error<br>This indicates that the memory used for storing the system software could be defective. | Reload the system software and try again.<br>Replace the CPU module PM820-2. |
| 45 | Stall timer defect<br>This is a hardware problem. | Replace the CPU module PM820-2. |
| 46 | UART defect<br>This is a hardware problem. | Replace the CPU module PM820-2. |
| 47 | RAM check failed<br>This is a memory problem and indicates inconsistencies of the data stored in the RAM. | Restart the system by pressing the INIT push button with the START MODE selector in either the CLEAR or AUTO position.<br>Replace the CPU module PM820-2. |
| 49 | Internal error<br>Indicates an unexpected state, usually due to a system error. | Restart the system by pressing the INIT push button with the START MODE selector in either the CLEAR or AUTO position.<br>Reload the application program and try again.<br>Replace the CPU module PM820-2. |
| 4A | Power failure<br>Indicates that the AC 80 was switched off or that there was a power failure. | Check the power supply for AC 80. |
| 4C | Address error<br>This is a software problem and indicates that the CPU is not working correctly. | Restart the system by pressing the INIT push button with the START MODE selector in either the CLEAR or AUTO position.<br>Reload the system software.<br>Replace the CPU module PM820-2. |
| 4D | Processor generated exception<br>This is a software problem and indicates that the CPU is not working correctly. | Restart the system by pressing the INIT push button with the START MODE selector in either the CLEAR or AUTO position.<br>Reload the system software.<br>Replace the CPU module PM820-2. |
| 4F | Battery buffered memory error<br>This indicates that the contents of the battery buffered RAM and real-time clock have been lost. This may happen if the battery was run down or not installed during a power failure. | Replace the battery and set the time and date using Advant Station 120ES. |
| 51 | Not available function block<br>Indicates that a function block (i.e., PC element or DB element) has been called which the current system software does not recognise. | Restart the system in STOP MODE.<br>Load the correct system software and options or reduce the application program to match current system software.<br>Load and deblock application again. |
| 55 | BOOT PROM error<br>This is a hardware error. | Replace the CPU module PM820-2. |
| 5D | Application in PROM generated for another system software release.<br>This may occur after loading of a new system software. | Restart the system in STOP MODE. Then generate new target code with a matching release of the AS 120 ES, download to PM820-2 and save it in PROM. |
| 63 | Missing option<br>Indicates that the application in PROM needs an option that is not part of the system software (probably due to download of new BASE system software). | Restart the system in STOP MODE. Then install the missing option and restart the system with the START MODE selector in either the CLEAR or AUTO position. |

### Checking the System Status Using FCB

Detailed AC 80 system status information is shown by FCB's Option, System and Attribute reports. Essential revision identification data is returned by the Option report (not the System report).

The Attribute report is the only way of finding out which bus number was specified for the station as its application was created with AdvaBuild. FCB can be used for connecting to the AC 80 through the Ch1 connector by specifying Bus=0, Station=0, which makes it possible to use the Attribute report. An empty line is returned by the report if the current station address and AF 100 bus number are in conflict with those saved in FLASH PROM.

The only way to correct the old bus number attribute in the AC 80 is to clear the application in the FLASH PROM and then to restart. After this, the Attribute report will show the bus number (BusNo) as 0, and StnNo as set with the address selection switches. No switches exist for BusNo, but as soon as FCB is connected to the AC 80 and Station number != 0 specified, the BusNo attribute is adopted by the AC 80, and returned thereafter by the Attribute report.

By the (Target | Diagnostics) command a dedicated "Diagnostics window" can be started. Here the following commands can be given:

- (Target | Report Errors) shows the same error report window as Status Report – Report Errors from main FCB window.
- (Target | List Modules) shows a list of connected S800 I/O modules.
- (Target | Diagnose Module) shows detailed information on the channels and common properties of the selected S800 module.

For further information on using FCB for diagnosing the PM825 (processor module of the AC 80) and connected S800 I/O modules, see FCB documentation, FCB on-line help, and the *S800 I/O User's Guide.*

### PC Element Error Terminals and Codes

Many programming errors as well as physical hardware faults and disturbances can be detected and corrected because most PC elements and some DB elements have error pins. Typically there is a Boolean ERR pin (which is "1" if the actual data elements are obsolete or invalid at the moment), and a numeric ERRC pin (which shows an error code, the interpretation of which is described in the *AC 80 PC Elements Reference Manual.*

Typically the ERR pin is cleared as soon as the element operates normally again, but the ERRC pin is cleared just when the user or application asserts the RESET input pin of the PC element. Some elements are sensitive to the rising edge of the reset signal, some to the status of same. An exception are the PC elements without a RESET input, whose error code is cleared as soon as the cause of the error disappears. There are even elements that are outside of the above-mentioned types, e.g. AF 100 PC elements that sustain their ERRC values until a rising edge of the signal on the ACT pin.

There is also a possibility of registering ERRC occurrences in event loggers by connecting the ERRC output to the ERROR PC element, which adds a time stamp to the event and stores it in the event logger. From there, the time stamp and the ERRC value can be observed with Drive*Window* or the CDP 80 panel (first two digits of the error code are converted to descriptive text, the last two digits are shown numerically). However, usually the ERRC pins are monitored with FCB, using its online mode and dynamic measurement features. It is also customary to use FCB to assert the RESET input pins temporarily to “1” with its “forcing function”.

It is highly recommended to connect the ERR pin to some logic PC elements of the application itself instead of having them checked sporadically by the application designer or service personnel. In most applications, an “ERR = 1” status indicates that the respective function is not safe to use and should therefore not be used at all. However, it is the application designer’s responsibility to write the program so that the “ERR = 1” status is handled the correct way (e.g. the system is stopped in a controlled manner). The AC 80 system does not register or react to ERR signals in any way. For the system program, ERR signals are ordinary, quite like any other output signals from the PC elements.

## *Using Drive*Debug

Drive*Debug* is a Windows-based diagnostic tool for devices that use the DDCS communication protocol. These devices include e.g. the AC 80 and the ACS 600. Drive*Debug* can be used for e.g. monitoring, trending and adjusting user-selectable memory locations.

The Drive*Debug* User’s Manual is included in the AC 80 Software Package (directory **Drideb**) as DRIDEB.DOC.

AC 80 User's Manual/EN
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**ABB Industry Oy**
Drives
P.O. Box 184
FIN-00381 Helsinki
FINLAND
Telephone: +358 10 222 000
Fax: +358 10 222 2681
Internet: http://www.abb.com/automation